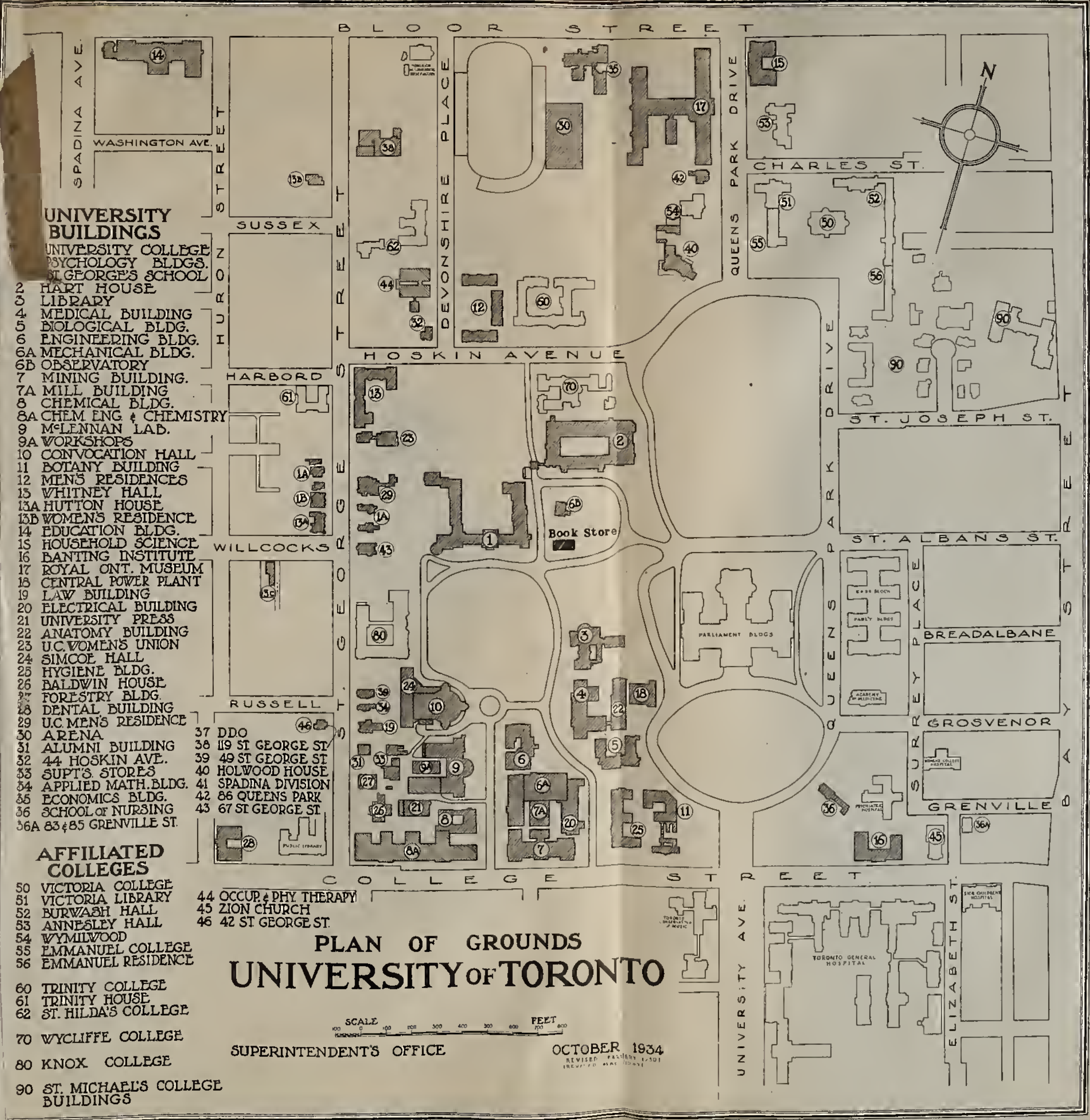
BLOOR STREET
SPADINA AVE.
WASHINGTON AVE.
HURON STREET
SUSSEX
HARBORD
WILLCOCKS
RUSSELL
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
CHARLES ST.
ST. JOSEPH ST.
ST. ALBANS ST.
BREADALBANE
GROSVENOR
GRENVILLE
SURREY PLACE
BAY STREET
COLLEGE STREET
UNIVERSITY AVE.
ELIZABETH ST.
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Book Store
PARLIAMENT BLDGS
TORONTO GENERAL HOSPITAL
UNIVERSITY BUILDINGS
1 UNIVERSITY COLLEGE
PSYCHOLOGY BLDGS.
ST. GEORGE'S SCHOOL
2 HART HOUSE
3 LIBRARY
4 MEDICAL BUILDING
5 BIOLOGICAL BLDG.
6 ENGINEERING BLDG.
6A MECHANICAL BLDG.
6B OBSERVATORY
7 MINING BUILDING.
7A MILL BUILDING
8 CHEMICAL BLDG.
8A CHEM ENG. & CHEMISTRY
9 McLENNAN LAB.
9A WORKSHOPS
10 CONVOCATION HALL
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36 SCHOOL OF NURSING
36A 83 & 85 GRENVILLE ST.
37 DDO
38 119 ST. GEORGE ST.
39 49 ST. GEORGE ST.
40 HOLWOOD HOUSE
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42 86 QUEENS PARK
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53 ANNESLEY HALL
54 WYMILWOOD
55 EMMANUEL COLLEGE
56 EMMANUEL RESIDENCE
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70 WYCLIFFE COLLEGE
80 KNOX COLLEGE
90 ST. MICHAEL'S COLLEGE BUILDINGS
44 OCCUP. & PHY. THERAPY
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46 42 ST. GEORGE ST.
PLAN OF GROUNDS
UNIVERSITY OF TORONTO
SCALE FEET
100 0 100 200 300 400 500 600 700 800
SUPERINTENDENT'S OFFICE
OCTOBER 1934

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science
and Engineering

1950-1951

THE UNIVERSITY OF TORONTO PRESS
1950

CONTENTS

CALENDAR 1950

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SECTION I. CALENDAR 1950-1951

FALL TERM, 1950

July 1	*Saturday*	Dominion Day. Buildings closed.
July 15	*Saturday*	Last day for receiving applications for supplemental examinations.
August 7	*Monday*	Civic Holiday. Buildings closed.
August 14	*Monday*	Students of the III Year, Courses 1, 2 and 9 report at Survey Camp (Course 1 at Dorset, Course 2 and 9 at Gull Lake).
August 28	*Monday*	Supplemental Examinations commence.
September 1	*Friday*	Last day for receiving applications for admission to the I Year.
September 4	*Monday*	Labour Day. Buildings closed.
September 11	*Monday*	Special meeting of Faculty Council.
September 14-16	*Thursday-Saturday*	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m., (Saturday 9.30 a.m. to 12.00 noon) at 119 St. George St.
September 18	*Monday*	Registration in person of the II and III Years from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Bldg.
September 19	*Tuesday*	Registration in person of the IV Year from 9.00 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m., at the Mining Building. Dean's address to the I Year. Preliminary instruction to the I Year.
September 20	*Wednesday*	Lectures and laboratory work commence at 9.00 a.m. The opening address by the President to the students of all Faculties at 3.45 p.m., in Convocation Hall.
September 26	*Tuesday*	Meeting of Faculty Council.
October 2	*Monday*	Meeting of Faculty Council.
October 7	*Saturday*	Meeting of Caput.
*October 9	*Monday*	Thanksgiving Day. Buildings closed.
October 10	*Tuesday*	Meeting of Engineering Society.

*Or such other date as may be determined by Order-in-Council.

October 13	*Friday*	Meeting of Senate.
November 1	*Wednesday*	Meeting of Faculty Council.
November 10	*Friday*	Meeting of Engineering Society. Fall Convocation and meeting of Senate.
November 11	*Saturday*	Remembrance Day Service at the Soldiers' Tower, at 10.45 a.m. Neither lectures nor laboratory classes given from 10.00 a.m. to 11.15 a.m.
December 1	*Friday*	Meeting of Faculty Council.
December 6	*Wednesday*	Meeting of Engineering Society.
December 8	*Friday*	Meeting of Senate.
December 20	*Wednesday*	Term ends at 5.00 p.m.

SPRING TERM, 1951

January 3	*Wednesday*	Spring Term begins. Mid-session Examinations commence.
January 10	*Wednesday*	Meeting of Faculty Council.
January 12	*Friday*	Meeting of Senate.
January 15	*Monday*	Last day for receiving the second term instalment of fees.
January 16	*Tuesday*	Meeting of Engineering Society
February 2	*Friday*	Meeting of Faculty Council.
February 8	*Thursday*	Meeting of Engineering Society.
February 9	*Friday*	Meeting of Senate.
February 21	*Wednesday*	Meeting of Engineering Society (nominations).
February 23	*Friday*	Engineering Society Annual Elections.
February 26	*Monday*	Engineering Society Annual General Meeting.
March 1	*Thursday*	Meeting of Faculty Council.
March 9	*Friday*	Meeting of Senate.
March 23	*Friday*	Good Friday. Buildings closed.
March 30	*Friday*	Term ends at 5.00 p.m.
April 3	*Tuesday*	Meeting of Faculty Council.
April 5	*Thursday*	Annual Examinations commence.
April 13	*Friday*	Meeting of Senate.
May 3	*Thursday*	Meeting of Faculty Council.
May 11	*Friday*	Meeting of Senate.
May 28	*Monday*	Meeting of Senate.
June 6, 7, 8	*Wednesday* *Thursday* *Friday*	University Commencement.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . . . Sidney Smith, K.C., M.A., LL.B., LL.D., D.C.L.

Registrar . . . . J. C. Evans, B.A.

Librarian . . . . W. S. Wallace, M.A., LL.D., F.R.S.C.

Warden of Hart House . . . . N. Ignatieff, M.B.E., B.SC.

Director of University Extension . . W. J. Dunlop, B.A., B.PAED., LL.D.

Assistant to the President . . . . C. T. Bissell, M.A., PH.D.

Comptroller . . . . R. E. Spence, B.A., A.C.A.

Bursar and Secretary to the Board of Governors C. E. Higginbottom, F.C.I.S.

Superintendent of Buildings and Grounds . . . A. D. LePan, B.A.SC.

Chief Accountant . . . . G. L. Court, D.F.C., B.COM., C.A.

Director of University Health Service . C. D. Gossage, O.B.E., M.D., F.R.C.S.

Assistant Director of University Health Service—Women
Miss F. H. Stewart, B.A., M.D.

Director of Athletics and Physical Education—Men . W. A. Stevens, B.S.

Director of Athletics and Physical Education—Women Miss Z. Slack, B.A.

Acting General Manager of the University of Toronto Press
A. G. Rankin, B.COM., C.A.

Editor of the University of Toronto Press G. W. Brown, M.A., PH.D., F.R.S.C.

General Secretary-Treasurer of the Students' Administrative Council
E. A. Macdonald, B.A.

Associate Secretary of the Students' Administrative Council
Miss A. E. M. Parkes, B.A.

Director of Hart House Theatre . . . . R. S. Gill, M.A.

Director of the Placement Service . . . J. K. Bradford, O.B.E., B.A.SC.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . . . K. F. Tupper, O.B.E., B.A.SC., S.M. (MICH)

Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.

SECTION III. TEACHING STAFF

1949-50

DEAN EMERITUS

C. R. Young, B.A.Sc., C.E., D.Eng., D.Ès.Sc.A., Hon. M.E.I.C., M.Am.Soc.CE. — 72 Roxborough Dr.
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Professor Emeritus of Chemical Engineering

G. A. Guess, M.A. (Qu.) — Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. Haultain, C.E. — National Club
Professor Emeritus of Mining Engineering

C. G. Williams, B.A.Sc. — 417 Rosemary Road
Professor Emeritus of Mining Engineering

DEPARTMENT OF AERONAUTICAL ENGINEERING

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R. D. Hiscocks. B.A.Sc. — c/o DeHavilland Aircraft Co., Downsview P.O.
Special Lecturer in Aeronautical Engineering

R. B. McIntyre, M.A. (Camb.) — c/o De Havilland Aircraft Co.
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J. D. Stewart, B.A.Sc. — Apt. 6, 1396 King St. W.
Instructor in Aeronautical Engineering

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E. L. Dodington, B.A.Sc. *Assistant Professor of Applied Physics*	415 Sutherland Dr.
J. J. Klawe, M.A.(Glasgow), Dip.I.E.C.(Grenoble) *Lecturer in Applied Physics*	128 Walmer Rd.
J. T. A. Atkinson, B.Eng., M.A.Sc.(McG.), Ph.D. *Special Lecturer in Applied Physics*	27 Bedford Rd.
F. B. Friend, B.A., M.A.(Rochester) *Lecturer in Applied Physics*	Lockie Ave., Agincourt
F. C. Hartley, B.A.(McM.) *Instructor in Applied Physics*	473 Sutherland Dr.
P. A. Macpherson, B.A.Sc. *Instructor in Applied Physics*	90 Cowan Ave.
J. R. Bird, B.A.Sc., M.A. *Instructor in Applied Physics*	56 Rathnelly Ave.
F. Weinberg, B.A.Sc., M.A. *Instructor in Applied Physics (part time)*	692 College St.
F. M. Hill *Instructor in Applied Physics*	25 Ridout Ave.
G. E. Noakes, B.A.Sc., M.A. *Instructor in Applied Physics (part time)*	588 Huron St.
J. W. Rutter, B.A.Sc., M.A. *Instructor in Applied Physics (part time)*	68 Boswell Ave.
J. E. Piercy, B.A.Sc., M.A.Sc. *Instructor in Applied Physics (part time)*	188 St. George St.
R. F. Johnston, B.A.Sc. *Instructor in Applied Physics (part time)*	48 Glynn Ave., Ajax
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J. E. Hogarth, B.A.Sc. *Instructor in Applied Physics (part time)*	46A Dorval Rd.
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Demonstrator in Chemical Engineering
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Demonstrator in Chemical Engineering
S. Zradowsky, B.A.Sc. — 276 Delaware Ave.
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SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture. On July 1, 1948, the School of Architecture was separated from the Faculty and became an independent School with its own Director and Council.

With the end of the Second World War during the summer of 1945 the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors and the President, the University leased from the Crown part of the large shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in the First Year and 1500 in the Second Year. In the 1947-48 session the enrolment at Ajax consisted of 1200 students in the First Year and 1400 in the Second Year. In the session 1948-49, 600 were registered at Ajax in the First Year and 975 in the Second Year. All other instruction was given in Toronto.

To provide for this self-contained University community at Ajax, there were 446 acres and 111 buildings. The University operated such services as central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence, in 1947-48 there were 1800 students and in 1948-49 there were 900. Student life at Ajax compared favourably with that in Toronto, excellent accommodation being provided for a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

With the completion of the Wallberg Building and the extension of the Mechanical Building, additional accommodation became available on the Queen's Park Campus, and this fact coupled with the decrease in numbers entering each year brought about the closing of Ajax on May 31, 1949.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

CHANGE IN ADMISSION REQUIREMENTS

Commencing with the Session 1950-51, applicants for admission to the Faculty of Applied Science and Engineering will be required to have at least third class honours in each subject of their Grade XIII examination.

GENERAL

1. Candidates for admission in 1950 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

Students from foreign countries must, in addition to providing the necessary equivalent certificates, give evidence of their ability to understand lecture and laboratory courses where the English language is used exclusively, and must demonstrate their ability to use this language in both the spoken and written form, with reasonable facility. Such students are strongly advised to spend a year in Grade XIII of an Ontario Secondary School before seeking admission to this Faculty.

3. Requirements for applicants presenting Ontario certificates.

Secondary School Graduation Diploma

No subjects are definitely prescribed, but the diploma must show credit in English and History, and in four of the optional subjects.

Grade XIII

Third Class honours are required in each subject.

English
Mathematics (Algebra, Geometry, Trigonometry)
Science (Chemistry and Physics)
One of French
German
Greek
Italian
Latin
Spanish

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are advised to select German as one of the admission subjects.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate, generally known as Junior and Senior Matriculation respectively, may be accepted in so far as they meet the admission requirements of the University of Toronto in subjects and percentages and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

Province of Quebec

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

Province of New Brunswick

Junior and Senior Matriculation certificates.

Province of Nova Scotia

High School certificates of Grade XI and Grade XII issued or endorsed by the Department of Education.

Province of Manitoba

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of British Columbia

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

Province of Prince Edward Island

Second and Third Year certificates issued by the Prince of Wales College.

Province of Alberta

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of Saskatchewan

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Newfoundland

Grade XI certificates of the Council of Higher Education (for Ontario Grade XII only).

Newfoundland and the Maritime provinces

Certificates of the Common Examining Board.

Great Britain

The Oxford and Cambridge Joint Board School certificate, or equivalent, indicating "Credit" or better standing in English Language and Literature, "Advanced" or "Additional" Mathematics, Physics, Chemistry (not general science), and a foreign language.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 11th to 20th (Saturday, September 16th, 9 a.m. to 12.30 p.m.), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

Schedule of Fees

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
First, Second, Third	$300	$42	$342	$192	$153
Fourth	300	52	352	202	153
Women					
First	$300	$28	$328	$178	$153
Second, Third	300	25	325	175	153
Fourth	300	35	335	185	153

*The Academic Fee includes the following fees:—
Tuition; Library, Laboratary Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Degree (for the final year only): Hart House; Students' Administrative Council; Athletic; Health Service; Physical Education; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For woman—Degree (for final year only); Students' Administrative Council; Athletic; Health Service; Physical Education (for the First Year only); Engineering Society; and Laboratory Deposit.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

DEGREE FEE

11. Each candidate for the degree of Bachelor of Applied Science must pay a fee of $10.00 to the Chief Accountant on or before the opening date of the session.

LABORATORY DEPOSIT

12. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

13. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 28.
2. Board and Lodging, per week.................. $15 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are eleven courses in Engineering, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8),
Ceramic Engineering (Course 8a),
Mining Geology (Course 9),
Aeronautical Engineering (Course 10),
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the above courses.

3. The courses extend over four academic years. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering may proceed to post-graduate and professional degrees. The post-graduate degrees are M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 139. Many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The course for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 208 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English, and Engineering and Society; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked

with the graduate courses (page 208), and with the work of the School of Engineering Research (page 32).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bnd itself to adhere for the whole period of a student's course to the condtions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, and Doctor of Philosophy, see pages 208 and 209 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 121.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (see subject 690.)

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above-mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 208. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	9	–	4
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Applied Physics	75, 76	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	284	–	9	–	6
Hydraulics, Elementary	447	1	–	–	–
Least Squares	494	–	–	1	2
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Practical Astronomy	200	1	–	2	–
Practical Experience	690	–	–	–	–
Surveying	714, 716	1	6	–	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Cements and Concrete	35, 44	1	3	1	–
Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	9	–	9
Business	310	–	–	1	–
Construction Surveying	718	1	–	1	–
Control Surveys and Mapping	201	–	–	2	–
Differential Equations	507	1	–	1	–
Engineering Geology	382, 383	2	1	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Machinery	463, 464	2	3	–	–
Modern World History	324	1	–	1	–
Photogrametry	81	1	–	–	–
Physical Metallurgy	546	1	–	–	–
Political Science	323	1	–	1	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics.......	313	–	–	1	–
Engineering Law.............	314	1	–	–	–
Highway Engineering.........	217	1	–	1	–
Hydraulics..................	445, 446	2	3	2	3
Industrial Management.......	318	1	–	1	–
Mechanics of Materials Lab...	38, 50	–	3	–	3
Modern Political and Economic Trends.........	325	1	–	1	–
Municipal Administration and Contracts................	216	1	–	1	–
Philosophy of Science.........	326	1	–	½	–
Practical Experience..........	690	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Sanitary Engineering.........	214, 215	1	3	1	3
Soil Mechanics and Foundations	40, 299	2	–	1	3
Railway Engineering.........	218	1	–	1	–
Reinforced Concrete..........	41, 299	1		1	
Structural Design............	43, 299	2	6	1	6
Theory of Structures.........	36, 299	2		2	
Thesis......................	730	–	–	–	2

MINING ENGINEERING

(Course 2)

The course in Mining Engineering, which originated in 1878 as a course in Assaying and Mining Geology, is intended to serve as a preliminary training for those who expect to practise in some branch of Mining Engineering, such as exploration of mining areas and primary development; mine surveying; mining processes involving civil, mechanical and electrical work; underground operations; mining machinery and operation; milling and treatment of ores; assaying and other forms of analysis and research; and administrative work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 121.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

Further information appears on page 208 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry.........	492	1	–	2	–
Calculus....................	490	2	–	2	–
Chemistry..................	221, 222	2	6	2	–
Descriptive Geometry........	270	1	–	1	–
Dynamics..................	21	1	–	2	–
Electricity.................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	276	–	6	–	6
English....................	610	1	–	1	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements...........	448	1	–	1	–
Mining Laboratory..	165	–	–	–	2
Physical Training...........	640	–	2	–	2
Practical Experience..........	691	–	–	–	–
Statics.....................	20	1	–	2	–
Surveying..................	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents.........	331, 350	1	–	1	3
Analytical Chemistry Laboratory..............	227	–	–	–	6
Chemistry..................	224	1	–	1	–
Descriptive Geometry........	272	1	–	1	–
Economics.................	311	2	–	2	–
Engineering Problems and Drawing................	285	–	6	–	6
Heat, Engines, Elementary....	420	1	–	–	–
Mechanics of Materials.......	23, 31	2	–	2	3
Mineralogy and Lithology....	386, 387	2	2	2	2

Second Year Subjects Course 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	6	1	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	–	1	6
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Cements and Concrete	35	1	–	1	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	–
Geological Field Work	410	–	–	–	–
Hydraulics	440, 441	2	$1\frac{1}{2}$	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399	2	–	2	–
Mining	168	1	–	1	–
Mining Laboratory	169	–	–	–	3
Modern World History	324	1	–	1	–
Ore Dressing	181, 182	–	–	2	6
Physical Chemistry	236	2	–	2	–
Political Science	323	1	–	1	–
Practical Experience	691	–	–	–	–
Principles of Mineral Dressing	180	2	–	–	–
Problems and Seminar	193	–	2	–	–
Structural Geology	397, 398	1	3	1	3
Summer Letters	191	–	–	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geological Excursions	409	–	1	–	–
Glacial Geology	384	1	–	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Management	171	–	–	2	–
Mine Ventilation	175, 176	2	3	–	–
Mining	170, 172	2	–	–	6
Mining Geology	405	–	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	183, 184	1	6	1	–
Physical Metallurgy	549	1	–	1	–
Practical Experience	691	–	–	–	–
Precambrian Geology	403	2	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	193	–	2	–	–
Philosophy of Science	326	1	–	½	–
Summer Essays	192	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(Course 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 121.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similiar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 208. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Elecrricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Mechanical Engineering	461	2	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines A	465	2	–	2	–
Treatment of Technical Data	449	–	–	2	–

Third Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345	–	–	2	–
Alternating Currents	340	2	–	–	–
Business	310	–	–	1	–
Electrical Laboratory	346	–	3	–	3
Elementary Structural Engineering	29, 293	1	3	1	3
Heat Engineering	422	2	–	2	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	–	2	3
Machine Design	467, 468	2	9	2	6
Modern World History	324	1	–	1	–
Physical Metallurgy	532	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	692	–	–	–	–
Theory of Machines B	466	2	–	–	–

Fourth Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Engine Laboratory	426	–	5	–	5
Heat Power Engineering	424	2	–	2	–
Physical Metallurgy II	547, 548	1	–	1	1½
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	–	1	–
Internal Combustion and Air-Craft Engines	425	1	–	1	–
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	692	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	3	–	–
Thesis	732	–	1	–	1

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 25 and 137 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 121.

FIRST YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	6	–	3
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits	354, 356	2	$1\frac{1}{2}$	2	$1\frac{1}{2}$
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	6	–	3
Physical Training	640	–	2	–	2

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

Third Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Electronics	366, 379	2	–	2	3
Heat	658	1	–	1	–
Machine Design	471, 472	1	3	1	3
Mathematical Methods in Physics I	656	1	–	1	–
Modern World History	324	1	–	1	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	549	1	–	1	–
Political Science	323	1	–	1	–
Properties of Matter	657	2	–	2	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5e, Electricity					
Electrical Machines	377, 378	2	3	2	3
Theory of Potential	667	1	–	1	–
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Geometrical Optics	660, 661	1	3	1	–
Option 5g, Geophysics					
Physical Geology	380, 381	2	2	2	2
Option 5t, Thermodynamics					
Hydraulics	450	1	–	1	–
Theory of Heat Engines	421, 423	2	3	2	3

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5e, Electricity					
Acoustics	97	2	–	–	–
Atomic Physics	663	2	–	2	–
Circuit Analysis	351	2	–	2	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Engineering Electronics	357, 358	2	1½	1	1½
Transmission at Low and High Frequency	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Mathematical Methods in Physics II	664	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Ultra-High Frequency Communication	371, 372	–	–	2	1½
Option 5s, X-Rays and Spectroscopy					
Analysis of Materials by Spectrographic and X-Ray Methods	669	1	–	1	–
Atomic Physics	663	2	–	2	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Mathematical Methods in Physics II	664	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Morphological Crystallography	390	1	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	–	–	2	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	9	–	9
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5g, Geophysics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 672	2	6	2	6
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Deposits	399	2	–	2	–
Mining Geology (Part)	405	–	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	397, 398	1	3	1	3
Thesis Seminar	733	–	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics	89, 90	2	3	2	6
Atomic Physics	663	2	–	2	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Mathematical Methods in Physics II	664	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	½	–
Photometry and Illumination Design	95, 96	2	3	2	6
Physical Laboratory	674	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5t, Thermodynamics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Machines	377, 378	2	3	2	3
Heat Engineering Laboratory	426	–	6	–	6
Heat Power Engineering	424	2	–	2	–
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	–	1	–
Low Temperature Physiology	211, 212	1	3	1	3
Machine Design	478	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Vibration Engineering	99, 100	1	3	1	3

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(COURSE 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more useful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical literature. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 121.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 208 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	223	–	–	–	9
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	9	–	3
English	610	1	–	1	–
German	613	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Engineering Problems	233	–	–	–	3
Chemical Laboratory I	232	–	9	–	–
Chemical Laboratory II	235	–	–	–	9
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	3
German	614	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	2	–

Second Year Subjects Course 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry	231	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234	2	–	2	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

Third Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Business	310	–	–	1	–
Chemical Engineering	242	2	–	–	–
Chemical Engineering Laboratory	243	–	–	–	3
Chemical Engineering Problems	248	–	–	–	3
Chemical Theory	240	–	–	2	–
Electrochemistry	246, 247	2	1½	–	–
Heat Engines, Theory	421, 428	2	–	2	1½
Hydraulics	440, 441	2	3	2	–
Industrial Chemistry	241, 249	1	–	1	12
Modern World History	324	1	–	1	–
Organic Chemistry	244, 245	2	9	2	–
Political Science	323	1	–	1	–
Public Speaking	319	1	–	1	–

Fourth Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	1	–	1	–
Chemical Engineering Problems	255	–	1	–	1
Chemical Laboratory	251	–	14	–	–
Chemical Theory	259	1	–	1	–
Engineering Law	314	1	–	–	–
Graphical Methods in Chemical Engineering	254	–	1	–	1
Industrial Chemistry	258	1	–	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Organic Chemistry	257	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Public Speaking	319	1	–	1	–
Thermodynamics	256	1	–	1	–
Thesis	734	–	6	–	19

ELECTRICAL ENGINEERING

(COURSE 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 121.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

About one-half of the time will be devoted to subjects chosen from mathematics, physics, and the fundamentals of electrical engineering. The other half may be devoted to power, electronics, or communications.

Further information appears on page 208. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 281	1	1	2	1
Calculus	490, 281	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 281	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	281	–	9	–	4
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 281	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491, 288	2	3	2	3
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–

Third Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342, 343	2	4	–	–
Electrical Problems and Seminar	335	–	2	–	2
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Application in Electricity Engineering	336	–	–	3	–
Modern World History	324	1	–	1	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	$4\frac{1}{2}$	–	$1\frac{1}{2}$
Electrical Problems and Seminar	359	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	$1\frac{1}{2}$	1	$1\frac{1}{2}$
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	2	–	2	–
*And at least three of the following subjects, one of which must be either Communications II or Alternating Current Machinery II:**					
Acoustics	82, 83	–	–	2	$1\frac{1}{2}$
Alternating-Current Machinery II	369, 370	–	–	2	$1\frac{1}{2}$
Communications II	362, 363	–	–	3	3
Electrical Design	373, 374	–	–	2	2
Illumination	93, 94	–	–	2	3
Ultra-High Frequency Communications	371, 372	–	–	2	$1\frac{1}{2}$

*Due to overcrowded facilities, it may be necessary, during the session 1950-51, to restrict the choice of elective subjects to certain groupings.

METALLURGICAL ENGINEERING

(Course 8)

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

Both physical and extractive metallurgy are based upon the sciences of chemistry and physics. It is believed that a wider knowledge of the basic sciences will bring to the student a readier appreciation of the technical problems with which he will be later confronted and a greater facility in their solution. To achieve this end, greater emphasis is placed upon physics and chemistry in the earlier years of the course. It follows that this course will be of greater value to students who have obtained a good standing in mathematics and science. In addition to instruction in extractive and physical metallurgy, engineering subjects are provided to give a general knowledge of mechanics of materials, machine design, etc. The course includes the non-technical subjects, such as Economics and English, which are common to all courses in the Faculty.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical Metallurgy courses cover the structure and properties of alloys, including microscopic, x-ray and mechanical methods of investigation.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 121.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 208 and in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Statics	20	1	–	2	–

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Chemistry Laboratory	228	–	6	–	6
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Metallurgy	530	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6

Third Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225	1	–	1	–
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	1½	3	–	–
Heat Engines, Theory	427, 428	1	–	1	1½
Metallurgical Theory	239	2	–	2	–
Modern World History	324	1	–	1	–
Ore Dressing	181, 182	–	–	2	6
Political Science	323	1	–	1	–
Principles of Metallurgical Engineering	534, 535	2	6	1	6
Principles of Physical Metallurgy	536, 537	2	3	2	3
Principles of Mineral Dressing	180	2	–	–	–
Refractories in Metallurgy	573	1	–	1	–

Fourth Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgical Theory	550	1	–	1	–
Metallurgy Problems	540	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Non-Ferrous Production Metallurgy	541, 542	2	6	2	–
Ore Dressing	183, 184	1	6	1	–
Philosophy of Science	326	1	–	½	–
Physical Metallurgy	543, 544	2	6	2	3
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	736	–	4	–	13

CERAMIC ENGINEERING

(Course 8a)

The course in Ceramics offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

In the manufacture of fused silicates, such as glasses, glazes and enamels, both clear and coloured and in the manufacture of special bodies such as those used for thermal and electrical insulation, practically every chemical element obtainable on a commercial basis may be used. The subject matter is essentially inorganic chemical engineering with an emphasis upon high temperature chemistry. The natural field of employment for graduates would be for the technical, production, sales and research divisions of the industry.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 121.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry and others approved by the School of Graduate Studies, while the remainder will be devoted to research in the same phase of the ceramic field.

Further information appears on page 208. The Calendar of the School of Graduate Studies should be consulted for further details.

First Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Statics	20	1	–	2	–

Second Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Chemical Laboratory	228	–	6	–	6
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	2	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	250	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6

Third Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	162	–	1½	–	–
Business	310	–	–	1	–
Ceramic Minerals and Calculations	560	4	–	2	–
Ceramics	562	–	–	2	–
Ceramics Laboratory	564	–	6	–	6
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	297	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	1½
Heavy Clay Products Laboratory	561	–	3	–	6
Mineralogy and Lithology	386, 387	2	2	2	2
Modern World History	324	1	–	1	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	1	–	1	–

Fourth Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Glass and Enamels	566	1	–	1	–
Hydraulics	440, 441	2	3	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Mineral Deposits (Part)	399	–	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing Laboratory	185	–	3	–	3
Philosophy of Science	326	1	–	½	–
Principles of Mineral Dressing	180	2	–	–	–
Profession of Engineering	327	–	–	½	–
Refractories and Ceramic Bodies	565	2	–	1	–
Thesis	737	–	10	–	13
Whitewares and Enamels Laboratory	568	–	6	–	6

MINING GEOLOGY

(Course 9)

The course in Mining Geology is designed for those who wish to enter the field of applied geology. It provides a training in all the fundamentals of the geological sciences, and a graduate in this course will be suitably trained to enter any of the branches of geology such as field and exploration work, mining geology, engineering geology, and petroleum geology.

The first year of the course in Mining Geology is identical with that in Mining Engineering. In the remaining years, while the emphasis is on geology, instruction is also given in the allied engineering fields. In this way the student in Geology is given a basic engineering training and an understanding of the extractive industries of mining and metallurgy.

The geological courses in the first and second years cover the general fields of physical geology, historical and stratigraphic geology, and minerals and rocks. The third and fourth years are spent in concentrated work on specialized topics as ore deposits, petroleum and structural geology, palaeontology, microscopic study of rocks and ores, Precambrian geology, glacial geology, mining geology, geology of Canada, and geophysics.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 121.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a higher degree.

Work for such degree will include the preparation of a thesis on an approved subject, together with the study of such subjects as advanced structural geology, economic geology, mining, metamorphism, and geophysics.

Further information appears on page 208. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining Laboratory	165	–	–	–	2
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	6
Chemistry	224	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	6	–	6
Heat Engines, Elementary	420	1	–	–	–
Historical and Stratigraphical Geology	393, 394	2	2	2	2
Mechanics of Materials	23, 31	2	–	2	1
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	6	1	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	–	1	6
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Geological Field Work	410	–	–	–	–
Historical Geology (1950-51 only)	393, 394	2	2	2	2
Metallurgy	530	1	–	–	–
Mineral Deposits	399, 400	2	3	2	3
Mining	168	1	–	1	–
Modern World History	324	1	–	1	–
Petrology	391, 392	2	2	2	2
Physical Chemistry	236	2	–	2	–
Political Science	323	1	–	1	–
Practical Experience	696	–	–	–	–
Principles of Mineral Dressing	180	2	–	–	–
Structural Geology	397, 398	1	3	1	3
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mineralogy	388	2	–	2	–
Engineering Economics	313	–	–	1	–
Geology of Canada	401, 402	2	–	1	2
Geological Excursions	409	–	1	–	–
Geophysics	671, 673	1	3	1	3
Glacial Geology	384	1	–	1	–
Mine Management	171	–	–	2	–
Mining	170, 172	2	–	–	6
Mining Geology	405, 406	1	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Petroleum Geology	407, 408	2	–	1	3
Practical Experience	696	–	–	–	–
Precambrian Geology	403, 404	2	–	–	3
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	1	–	½	–
Physical Metallurgy	549	1	–	1	–
Thesis	738	–	6	–	–

AERONAUTICAL ENGINEERING

(COURSE 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 25 and 137 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies. In Canada, Great Britain and the United States, due to the necessary emphasis on mass production for war purposes, there is a shortage of personnel training to enter design staffs. In these countries there will be opportunities for graduates in Aeronautical Engineering.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 121.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 208. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Aeronautics	1	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	286	–	3	–	3
Heat Engines, Elementary	420	1	–	–	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	2	–	2	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	1	3	1	3
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Electrical Engineering	375, 376	2	3	2	3
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	3	2	6
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Hydraulics	452	1	–	–	–
Aircraft Propulsion	11	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Gas Dynamics	26	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physical Metallurgy	549	1	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(Course 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderantly engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Calculus 491, page 121.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course (see Practical Experience, 698, page 132).

FIRST YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	6	–	8
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	532	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Public Speaking	320	–	–	–	–

Third Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	1	2	1
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	298	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

Fourth Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	–	–	2	3
Business Policy	309	3	2	3	2
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Illumination and Acoustics	91, 92	1	$1\frac{1}{2}$	1	$1\frac{1}{2}$
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy II	547, 548	1	–	1	$1\frac{1}{2}$
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Structural Engineering	46, 300	2	3	–	–
Thesis	740	–	1	–	1

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 35.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, II Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text book: Technical Aerodynamics—K. D. Wood.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamic theory, in which the following topics are discussed: performance estimation and calculation, airfoil theory, propellors, wind tunnel corrections, drag, stability and control, spinning, rotary wing aircraft, compressibility effects.

Text books: Applied Aerodynamics—Bairstow. Airfoil and Airscrew Theory—Glauert. Aerodynamics of the Airplane—Millikan. Aerodynamics Theory—Durand.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon, W. H. Jackson, W. Czerwinski, R. D. Hiscocks.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

The preliminary design of light aircraft is discussed in these lectures. It is intended to give the student a grasp of the principles of balance and load distribution necessary for the design of the various components. About three quarters of these lectures are given in a class room, the remainder being given in the laboratory where practical work is carried out.

Text books: Civil Airworthiness Requirements (British). Civil Aeronautics Manual 04 (U.S.).

6. Airplane Design and Layout Laboratory. T. R. Loudon, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

This course is divided roughly into three periods devoted respectively to the preliminary design of light aircraft, fitting design and layout and final design of a light aircraft project which is actually constructed under the supervision of skilled aircraft mechanics. The course gives the practical application of the lectures in course 5.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text book: Analysis and Design of Airplane Structures—Bruhn.

8. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 3 hrs. laboratory per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. Some of this work is taken in conjunction with light aircraft design in laboratory work described in subject 6.

9. Airplane Stress Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

These lectures serve as an introductory course to the advanced structural analysis used in aircraft design in the fourth year.

Text books: Analysis and Design of Airplane Structures—Bruhn. Fundamentals of Aircraft Structures—Barton.

10. Airplane Stress Analysis Laboratory. T. R. Loudon.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aircraft Propulsion. R. B. McIntyre.

Course 10, IV Year; 1 hr. lecture per week, both terms.

This course of lectures deals with theory of the propeller. The principles of operation of the reciprocating engine, turbo jet, gas turbine and rocket are explained.

12. Aircraft Layout. W. Jackson, R. D. Hiscocks.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures.

Text book: Applied Statics—Loudon.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith, F. C. Hooper, W. E. Morley, J. M. F. Vickers.

Courses 1, 3, 7, and 11, II Year; 1 hr. lecture per week, both terms.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Text book: Mechanics—Den Hartog.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text book: Resistance of Materials—Seely.

24. Applied Mechanics. T. R. Loudon, B. Etkin.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed structures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text books: Applied Statics—Loudon. Principles of Physics, Mechanics—Sears.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vectors; general plane motion of particles systems

of particles, and rigid bodies; compound pendulum, centre of percussion, gyroscopes.

Text books: Engineering Mechanics (vol. 2)—Timoshenko and Young. Principles of Mechanics—Synge and Griffiths.

26. Gas Dynamics. G. N. Patterson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods.

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Introduction to the operators curl, div. and grad. Plane and Space dynamics using the vector rotation. Euler's equation for a rigid body. Lagranges equations. Vibrations. Dimensional analysis and model testing.

Text books: Principles of Mechanics—Synge and Griffiths. Engineering Mechanics (vol. 2)—Timoshenko and Young.

28. Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young and Morrison. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. C. F. Morrison, M. W. Huggins.

Courses 2, 3, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9, and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Vector operators; classical equations for perfect fluids, velocity potential, stream function, complex potential. Vorticity, circulation, flow past cylinder with lift. Hydraulic machinery, torque converter. Simple cases of viscous flow.

Text books: Treatise on Hydromechanics—Ramsay. Airfoil and Airscrew Theory—Glauert. Fluid Mechanics—Hunsaker and Rightmire.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Courses 1 and 2, III year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool Elementary Structural Engineering—Urquhart and O'Rourke.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by

analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

40. Soil Mechanics and Foundations. T. R. Loudon, W. L. Sagar.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

The design of foundations, retaining walls and dams is discussed in detail preliminary to working out problems in the laboratory.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer. Design of Concrete Structure—Urquhart and O'Rourke.

41. Reinforced Concrete. M. W. Huggins.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

43. Structural Design. M. W. Huggins.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind load-

ing, wind bracing, rigid frames, crane runways, cableways, head-frames, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum. Structural Problems—Young and Morrison.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 3 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, first term.

A study is made of various types of industrial buildings and other structures Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson. Structural Problems—Young and Morrison.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. J. T. N. Atkinson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics—Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. J. T. N. Atkinson.
Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.
Supplementing subject 70.

75. Applied Physics. E. L. Dodington.
Course 1, II Year; 1 hr. lecture per week, both terms.
Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.
Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. E. L. Dodington.
Course 1, II Year; 3 hrs. laboratory per week, both terms.
Supplementing subject 75.

81. Photogrametry. K. B. Jackson.
Course 1, III Year; 1 hr. lecture per week, first term.
An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Acoustics. V. L. Henderson.
Course 7, IV Year; 2 hrs. lectures per week, second term.
This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.
Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

83. Acoustics Laboratory. V. L. Henderson.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Supplementing course 82.

89. Architectural Acoustics. V. L. Henderson.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

90. Architectural Acoustics Laboratory. V. L. Henderson.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 89.

91. Illumination and Acoustics. V. L. Henderson.
Course 11, IV Year; 1 hr. lecture per week, both terms.
The production of light and the engineering principles underlying its utilization.
The generation and control of sound.

92. Illumination and Acoustics. V. L. Henderson.

Course 11, IV Year; $1\frac{1}{2}$ hrs. laboratory per week, both terms.

A laboratory course supplementing course 91.

93. Illumination. E. L. Dodington.

Course 7, IV Year; 2 hrs. lecture per week, second term.

Illuminating Engineering dealing with the nature, measurement, and production of light and related radiations.

Theory of human vision; the design and application of lighting equipment for visual efficiency and comfort. Fundamentals of power supply.

94. Illumination Laboratory. E. L. Dodington.

Course 7, IV Year; 3 hrs. per week, second term.

Supplementing subject 93.

95. Photometry and Illumination Design. E. L. Dodington.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. E. L. Dodington.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

99. Vibration Engineering. V. L. Henderson.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ASSAYING, MINING AND ORE DRESSING

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved. but also upon the errors inherent in operators as well as in methods,

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich. The Sampling and Assay of the Precious Metals—E. A. Smith.

161. Assaying Laboratory. M. Hewer.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

The determination of precious metals. Scorification, crucible and combination wet and dry methods of assaying ores both simple and complex; milling and metallurgical products including cyanide solutions, cyanide precipitates and gold bullion. Special attention is given to the sampling and assay of ores containing metallics.

162. Assaying Laboratory. M. Hewer.

Course 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lectures periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for ceramic engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. The Staff in Mining Engineering.

Courses 2 and 9, I Year; 2 hrs. per week, second term.

A combined laboratory and lecture course. It is an introduction to the principles of mining and sampling calculations. The rock drill, the handling of explosives, mine car loaders, and safety precautions, are also discussed.

166. Mining. R. E. Barrett.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

A course of lectures relating to underground and surface mining methods, rock boring machinery and practice.

168. Mining. R. E. Barrett.

Courses 2 and 9, III Year; 1 hr. lecture per week, both terms.

Methods of mine development by mine adits, shafts, drifts and crosscuts; stoping methods, loading, and underground transportation.

169. Mining Laboratory. S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, second term.

Special mining problems are given relating to sampling, diamond drilling, stope measurements, the factors affecting the angle of repose of broken materials and the behaviour of such materials when in motion. To develop the individual students' initiative, some special survey problems are worked in the laboratory.

170. Mining. R. E. Barrett.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

Advanced studies of stoping methods, deep mining problems, mine mechanization, underground crushing, hoisting, and communications.

171. Mine Management. R. E. Barrett.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, second term.

The discussion of certain aspects of business organization; option agreements, structure and financing of mining companies; mine plant and camp layouts; mine cost accounting and estimating; mine safety and hygiene; mine evaluation; labour relations—including a study of unions, collective bargaining agreements and associated problems.

172. Mining Laboratory. R. E. Barrett.

Courses 2 and 9, IV Year; 6 hrs. laboratory per week, second term.

Problems in mine planning involving shaft location and size; mine development; choice of stoping methods, mining rate, and mine equipment; time and cost schedules; ore reserve calculations.

175. Mine Ventilation and Allied Problems. G. R. Lord.

Course 2, IV Year; 2 hrs. lectures per week, first term.

Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

176. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.

Course 2, IV Year; 3 hrs. laboratory per week, first term.

Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

180. Principles of Mineral Dressing. S. E. Wolfe.

Courses 2, 8, and 9, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

This special course of lectures includes pertinent references to those fundamental laws of physics and chemistry, which apply to surfaces and affect surface tension, capillarity, the properties of colloidal solutions, pH, and the rate of filtration, etc. These are essential to the understanding of mineral dressing principles studied in the subsequent courses.

181. Ore Dressing. S. E. Wolfe.

Courses 2 and 8, III Year; 2 hrs. lectures per week, second term.

The general principles of ore dressing are discussed with particular attention to various beneficiating processes and their application in modern machines used for comminution, sizing, and gravity concentration.

182. Ore Dressing Laboratory. S. E. Wolfe.

Courses 2 and 8, III Year; 6 continuous hrs. laboratory work per week, second term.

This work is coordinated with lecture course 181 Studies are made of crushing machinery, the principles of crushing and grading rock products, screen analysis, and the sampling of broken material and mill products Certain tests with gravity concentrating equipment are made.

183. Ore Dressing. S. E. Wolfe.

Course 2 and 8, IV Year; 1 hr. lecture per week, both terms.

The subjects covered are extensions of those in 181 and 182. Flowsheets, cyanidation, flotation processes and technique, the current practice at milling plants, and special milling problems are discussed.

184. Ore Dressing Laboratory. S. E. Wolfe.

Courses 2 and 8, IV Year; 6 continuous hours per week, first term.

Advanced work coordinated with lecture course 183 and pertaining to ore dressing appliances, the handling in bulk of finely divided solids, the selective flotation of sulphides, ore testing, and check mill runs.

185. Ore Dressing Laboratory. S. E. Wolfe.

Course 8a, IV Year; 3 hrs. laboratory per week, both terms.

The principles of sampling, crushing, grading, screen analysis, concentration with gravity equipment, flotation, ore testing, etc., with special reference to industrial rocks and minerals.

190. Theory of Measurements. S. E. Wolfe.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

Engineering work requires the practical utilization of measurements which have varying degrees of precision. This course deals with the philosophy underlying the causes of errors, their effect and relative importance upon computed results, and the interpretation of numbers to represent measurements. The use of charts and graphs to illustrate certain measurements and the derivation of empirical equations from these charts is also considered.

191. Summer Letters. R. E. Barrett.

Course 2, III Year.

A series of letters written during the summer vacation, dealing with various aspects of a mining engineer's work. These are intended to direct and help the student's powers of observation and analysis, as well as being exercises in the art of lucid technical expression.

Special instructions will be issued in connection with these letters.

192. Summer Essays. R. E. Barrett.

Course 2, IV Year.

An essay, or report, written on a mining subject, preferably some phase of work with which the student is associated during summer employment. Subsequently, each student will deliver a talk to his class on the subject chosen. Thus, training is afforded in both technical writing and public speaking. Students are briefed in advance concerning requirements of this course.

193. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. J. W. Melson, H. L. Macklin.

Course 1, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

The derivation of formulae and their application to the solution of spherical triangles and practical problems. Practical determination of time, latitude and azimuth by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Text books: Nautical Almanac for current year and printed lecture notes.

201. Control Surveys and Mapping. O. J. Marshall.

Course 1, III Year; 2 hrs. lectures per week, second term.

Principles and Methods of control surveys involving triangulation, traverse, and levelling of various degrees of precision; elementary geodesy and map projections.

Text books: Higher Surveying—Breed and Hosmer, Vol. II, 5th Ed. Surveying, Theory and Practice—Tracy.

BOTANY

211. Low Temperature Physiology. G. H. Duff.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.
Course 5t, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, W. M. Walkinshaw.
Course 1, IV Year; 3 hrs. per week, both terms.
Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration and Contracts. A. E. Berry, W. Storrie.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 299.
Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, also forms an essential feature of the instruction.
Text book: Engineering Law—Laidlaw and Young.

217. Highway Engineering. W. L. Sagar.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Principles governing the location, design, and construction of highways and airports.

218. Railway Engineering. W. M. Treadgold.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Principles governing location, design and construction of railways.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. C. P. Brockett, W. F. Graydon.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.
Chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, W. F. Graydon.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 6 hrs. laboratory per week, one term.

A laboratory course illustrating the fundamental laws of chemistry as dealt with in the lecture course, and providing an introduction to chemical analytical methods.

223. Analytical Chemistry Laboratory. L. J. Rogers, W. F. Graydon.
Course 6, I Year; 9 hrs. laboratory per week, second term.
Systematic qualitative and quantitative inorganic analysis.

224. Chemistry. J. G. Breckenridge.
Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.
An introduction to modern theories of molecular structure, and to organic chemistry.

225. Analytical Chemistry. L. J. Rogers.
Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.
Principles of chemical analysis; select volumetric and gravimetric methods; technical analysis.

226. Engineering Chemistry. The Staff in Chemical Engineering.
Courses 1, 3, 7, and 11, II Year; 1 hr. lecture per week, both terms.
Water-treatment, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. E. A. Smith, W. F. Graydon.
Courses 2 and 9, II Year; 6 hrs. laboratory per week, second term.
Volumetric and gravimetric analysis.

228. Analytical Chemistry Laboratory. L. J. Rogers.
Courses 8 and 8a, II Year; 6 hrs. laboratory per week, both terms.
Gravimetric and volumetric methods, acidimetry and alkalimetry.
Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

230. Industrial Chemistry. E. A. Smith.
Courses 6 and 8a, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Course 11, II Year; 1 hr. lecture per week, both terms.
Manufacture of acids, alkalies, and inorganic chemicals; water-treatment, corrosion, explosives.

231. Inorganic Chemistry. C. P. Brockett.
Courses 6, 8 and 8a, II Year; 1 hr. lecture per week, both terms.
The periodic table and systematic inorganic chemistry.

232. Chemical Laboratory I. E. A. Smith, W. G. MacElhinney.
Course 6, II Year; 9 hrs. laboratory per week, first term.
A laboratory course including several methods of technical analysis, selected standard analytical procedures, and instruction in glass-blowing.

233. Chemical Engineering Problems. W. G. MacElhinney.
Course 6, II Year; 3 hrs. laboratory per week, second term.
An introductory course in industrial chemical calculations.

234. Organic Chemistry. J. G. Breckenridge.
Course 6, II Year; 2 hrs. lectures per week, both terms.
An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

235. Chemical Laboratory II. R. R. McLaughlin, J. G. Breckenridge.
Course 6, II Year; 9 hrs. laboratory per week, second term.
A laboratory course in organic chemistry to accompany subject 234.

236. Physical Chemistry. R. L. McIntosh.
Courses 6, 8, and 8a, II Year; Courses 2 and 9, III Year; 2 hrs. lectures per week, both terms.
Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

237. Analytical Chemistry Laboratory. L. J. Rogers.
Courses 2 and 9, III Year; 6 hrs. laboratory per week, second term.
Technical analysis of ores and furnace products; wet assaying.

239. Metallurgical Theory. W. C. Macdonald.
Course 8, III Year; 2 hrs. lectures per week, both terms.
A course dealing particularly with chemical theory as applied to metallurgical reactions.

240. Chemical Theory. R. R. McLaughlin, W. C. Macdonald.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term.
Chemical theory.

241. Industrial Chemistry. E. A. Smith.
Course 6, III Year; III Year Honour Chemistry; 1 hr. lecture per week, both terms.
Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, fermentation industries, etc.

242. Chemical Engineering. W. C. Macdonald, G. W. Minard.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.
Text book: Elements of Chemical Engineering—Badger and McCabe.

243. Chemical Engineering Laboratory. W. C. Macdonald, G. W. Minard.
Course 6, III Year; 3 hrs. laboratory per week, second term.
Experiments in chemical engineering to accompany part of subject 242.

244. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234.

245. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III; 9 hrs. laboratory per week, first term.
A laboratory subject accompanying lecture subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 2 hrs. lectures per week, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Courses 6 and 8, III Year; 18 hrs., first term.
Quantitative measurements to accompany subject 246.

248. Chemical Engineering Problems. W. G. MacElhinney.
Course 6, III Year; 3 hrs. laboratory per week, second term.
A continuation of subject 233.

249. Industrial Chemistry Laboratory. E. A. Smith, W. G. MacElhinney.
Course 6, III Year; 12 hrs. laboratory per week, second term.
A continuation of subject 232 including technical German translation.

250. Organic Chemistry. J. G. Breckenridge.
Courses 5 and 8a, II Year; 1 hr. lecture per week, both terms.
General reactions and methods of synthesis of carbon compounds.
Text book: Chemistry of Organic Compounds—Conant.

251. Chemical Laboratory. Staff in Chemical Engineering.
Course 6, IV Year; 14 hrs. laboratory per week, first term.
A continuation of subject 243, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, organic, and analytical chemistry.

253. Chemical Engineering. G. W. Minard.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 242.

254. Graphical Methods in Chemical Engineering. G. W. Minard.
Course 6, IV Year; 1 hr. laboratory per week, both terms.
This subject gives the student instruction and practice in the use of elementary principles for constructing nomograms, and the derivation of empirical equations by graphical methods.

255. Chemical Engineering Problems. W. G. MacElhinney.
Course 6, IV Year; 1 hr. laboratory per week, both terms.
Calculations in connection with various problems in chemical engineering.

256. Thermodynamics. W. C. Macdonald.

Course 6, IV Year; 1 hr. lecture per week, both terms.

Chemical thermodynamics, dealing with problems in chemical engineering.

257. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.

Course 6, IV Year; 1 hr. lecture per week, both terms.

A continuation of subjects 234 and 244.

258. Industrial Chemistry. E. A. Smith, W. G. MacElhinney.

Course 6, IV Year; 1 hr. lecture per week, first term.

IV Year Forestry; 1 hr. lecture per week, both terms.

Pulp and paper, and cellulose industries.

259. Chemical Theory. W. C. Macdonald.

Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A course on applied chemical kinetics and Phase Rule.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. J. R. Cockburn, A. Wardell.

All Courses, I Year; 1 hr. lecture per week, both terms.

This subject deals chiefly with the principles of orthographic and oblique projections and the application of such principles to the solutions of problems relating to straight lines and planes.

272. Descriptive Geometry. J. R. Cockburn, A. Wardell.

Courses 1, 2, 3, 7, 9, 10, and 11, II Year; 1 hr. lecture per week, both terms.

A continuation of the work taken in the First Year, with the following additions: problems relating to curved surfaces, principles of shades, shadows and perspective.

ENGINEERING PROBLEMS AND DRAWING

These subjects consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems are intended to supplement certain lecture courses. The problems in the First and Second Years deal with the fundamental engineering studies—Mathematics, Applied Mechanics, Descriptive Geometry, the plotting of surveys that have been made by the students in the field, Theory of Machines, while in the Third and Fourth Years, the problems deal mainly with design. During the hours devoted to mathematical problems, members of the staff in mathematics are present to assist.

275. Engineering Problems and Drawing. A Wardell.

Course 1, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Drawing and lettering. Plotting of original surveys. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus).

276. Engineering Problems and Drawing. A. Wardell.

Courses 2 and 9, I Year; 6 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 275.

277. Engineering Problems and Drawing. A. Wardell.

Courses 3 and 11, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.

Similar to subject 275.

279. Engineering Problems and Drawing. A. Wardell.

Course 5, I Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Course 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.

Course 6, I Year; 9 hrs. per week, first term; 3 hrs. per week, second term.

Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

281. Engineering Problems and Drawing. A. Wardell.

Course 7, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Similar to subject 275.

282. Engineering Problems and Drawing. A. Wardell.

Courses 8 and 8a, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 275.

284. Engineering Problems and Drawing.

Course 1, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing.

Courses 2 and 9, II Year; 6 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheet. Plotting of original surveys.

286. Engineering Problems and Drawing.

Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.

Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of machines. Problems in mathematics (calculus).

Course 10, II Year; 3 hrs. per week, both terms.

287. Engineering Problems and Drawing.

Course 6, II Year; 3 hrs. per week, both terms.

Problems in mechanics of materials and mathematics. Flow sheets.

288. Engineering Problems and Drawing.

Course 7, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 286.

289. Engineering Problems and Drawing.

Courses 8 and 8a, II Year; 3 hrs. per week, both terms.

Problems in mechanics of materials and mathematics.

291. Engineering Problems and Drawing. W. B. Dunbar.

Course 1, III Year; 9 hrs. per week, both terms.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses. Problems in descriptive geometry to illustrate the theory of map making.

292. Engineering Problems and Drawing. W. B. Dunbar.

Course 2, III Year; 3 hrs. per week, first term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

293. Structural Design Drawing. W. B. Dunbar.

Course 3, III Year; 3 hrs. per week, both terms.

Similar to subject 292.

297. Engineering Problems and Drawing. W. B. Dunbar.

Course 8a, III Year; 3 hrs. per week, both terms.

Similar to subject 292.

298. Structural Design Drawing. W. B. Dunbar.

Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Similar to subject 292.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.

Course 1, IV Year; 6 hrs. per week, both terms.

Advanced problems on the design of steel and reinforced concrete structures—floor panels, mill buildings, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems on moment distribution in rigid frames influence lines, and deflection of trusses.

300. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.

Courses 3 and 11, IV Year; 3 hrs. per week, first term.

Problems on the determination of stresses in, and the design of mill, building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. S. G. Hennessey.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

An introduction to the theory and practice of Accounting, the procedures followed in the preparation of financial statements, and the use of Accounting as a means of control.

307. Statistics. R. J. Sutherland.

Course 11, III Year; 2 hrs. lectures per week, both terms.

An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. R. F. White.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

A survey of contemporary economic institutions and problems and the application of economic theory to income determination, money and banking,i ndustrial fluctuations, fiscal policy and labour problems.

309. Business Policy. A. W. Currie.

Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.

Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8, 8a, and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. W. G. Phillips.

All courses, II Year; 2 hrs. lectures per week, both terms.

An Introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An introduction to Political Economy—Bladen.

313. Engineering Economics. J. W. Church.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management. R. E. Barrett.

Course 8, IV Year, 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of management, including labour relations, plant organizing, maintenance and safety.

318. Industrial Management. E. A. Allcut, C. E. Olive.

Courses 1, 3, 6, 7, and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.

Course 6, III Year; Course 6, IV Year; 1 hr. per week, both terms.

320. Public Speaking. G. A. McMullen.

Course 11, II Year; 1 hr. lecture per week, second term.

Principles of public speaking, and the means of expression, accompanied by practical application and training in actual speaking.

321. Industrial Management A. E. A. Allcut.

Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. laboratory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

322. Engineering and Society. G. K. Goundrey.

All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. J. Garner.

All courses, III Year; 1 hr. lecture per week, both terms.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Canada and the United States in the Modern World. J. M. S. Careless, G. M. Craig.

All courses, III Year; 1 hr. lecture per week, both terms.

An outline of the chief trends and developments since the American Revolution.

325. Modern Political and Economic Trends. J. C. Langley.

All courses, IV Year; 1 hr. lecture per week, both terms.

A study of the theory and practice of modern economic and political trends.

326. Philosophy of Science. Marcus Long.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 18 lectures, first term, and part of second term.

The relation between Science and Philosophy; an examination of the presuppositions of science and its basic concepts; alternative accounts of the nature of the universe with their implications for social and moral behaviour.

327. The Profession of Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering.

328. Industrial Management B. C. E. Olive.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service, etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. Staff in Electrical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference books: Introduction to Electrical Engineering—Mueller. Electrical Engineering—Christie.

331. Alternating Currents. A. G. Ratz.

Courses 1, 2 and 9, II Year; 1 hr. lecture per week, both terms.

Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. Staff in Electrical Engineering.

Courses 3, 6, and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculations of electrical circuits, particularly as applied to the measurement of resistance, current, potential

difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. H. F. Philp.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

334. Electrical Laboratory.

Courses 3, 6, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

335. Electrical Problems and Seminar.

Course 7, III Year; 2 hrs. per week, both terms.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair.

Course 7, III Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the application of electronics to electrical engineering.

Reference book: Applied Electronics—M.I.T. Staff.

338. Direct Current Machines. The Staff in Electrical Engineering.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, second term.

A course on the theory and operation of direct current generators and motors.

Reference books: Electrical Engineering, I Vol.—Dawes. Electrical Circuits and Machinery, Vol 1—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

339. Direct Current Machines. G. F. Tracy, D. N. Cass-Beggs, R. Scott.

Course 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering. Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. G. F. Tracy and staff.

Courses 3 and 11, III Year; 2 hrs. lectures per week, first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. J. E. Reid, B. de F. Bayly.

Course 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, transformers, and other electrical equipment.

343. Electrical Design Laboratory. L. S. Lauchland.

Course 7, III Year; 4 hrs. laboratory per week, first term.

To accompany subject 342.

344. Electrical Laboratory.

Course 7, III Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. G. F. Tracy and staff.

Course 2, III Year; Course 11, IV Year; 2 hrs. lectures per week, second term.

Characteristics of alternating current machines and the various methods of control.

346. Electrical Laboratory.

Course 2, III Year; 3 hrs. laboratory per week, both terms.

Course 11, III Year; 3 hrs. laboratory per week, first term.

Course 11, IV Year; 3 hrs. laboratory per week, second term.

Experiments on alternating current circuits and machines.

348. Electrical Machinery. C. E. Doeringer.

Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.

Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory.

Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.

Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory.

Courses 1, 2, and 9, II Year; 3 hrs. laboratory per week, second term.

Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Current Analysis. V. G. Smith.

Course 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.

Course 5e, IV Year; 2 hrs. lectures per week, both terms.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in

three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid, G. Sinclair, L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, both terms.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are anlyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. D. N. Cass-Beggs, G. F. Tracy.

Course 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Electric Circuits. L. S. Lauchland.

Course 5, II Year; 2 hrs. lectures per week, both terms.

Principles of direct-current circuits including the more important methods of measuring resistance, potential difference, current, power and energy. Principles of alternating-current circuits together with methods of calculating single-phase and polyphase circuits, network theorems.

355. Electrical Laboratory.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week, second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electric Circuits Laboratory.

Course 5, II Year, 3 hrs. laboratory alternate weeks, both terms.

Laboratory exercises to accompany subject 354.

357. Engineering Electronics. D. N. Cass-Beggs.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, first term 1 hr. lectures per week, second term.

Electronic devices, such as the thyratron, ignition and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.

Course 7, IV Year; 2 hrs. per week, both terms.

360. Communications I. J. E. Reid, G. Sinclair.

Courses 5e, 5i, 5s, and 7, IV Year; 3 hrs. lectures per week, first term.

The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.

Reference books: Applied Electronics—M.I.T. Staff.

361. Communications Laboratory.

Courses 5e, 5i, 5s, and 7, IV Year; 3 yrs. laboratory per week, first term.

Experiments and problems to accompany subject 360.

362. Communications II. J. E. Reid, G. Sinclair.

Courses 5e and 7, IV Year; 3 hrs. lectures per week, second term.

A continuation of subject 360.

363. Communications Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory per week, second term.

Experiments and problems to accompany subject 362.

364. Operational Methods. V. G. Smith.

Courses 5e, 5i, and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and

transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Cicuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus—Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5e, 5g, and 5s, IV Year; 2 hrs. lectures per week, both terms.

The laws of electromagnetism are reviewed and Maxwell's field equations developed. Plane electromagnetic waves and their reflection and refraction at plane surfaces are studied. Skin effects in cylindrical conductors, both solid and hollow are considered. Transmissions of energy by wave guides and co-axial cables is investigated. The laws and formulae of the radiation of energy from vertical antennae are developed. The capacity of cables and transmission lines is computed and comparison made between the exact and approximate formulae. Magnetic fields due to conductors carrying current in the neighbourhood of ferromagnetic bodies are investigated in some of the more simple cases.

Reference books: Electromagnetic Theory—Heaviside. Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague.

366. Electronics. B. de F. Bayly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Basic theory of the behaviour of electrons in electric and magnetic fields, thermionic emission, vacuum-tube characteristics and applications, conduction through gases, gaseous-tube characteristics and applications.

Reference books: Applied Electronics—M.I.T. Staff.

369. Alternating Current Machinery II. G. F. Tracy, D. N. Cass-Beggs.

Course 7, IV Year; 2 hrs. lectures per week, second term.

A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, second term.

Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises and problems to accompany subject 371.

373. Electrical Design. L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, second term. A continuation of subject 342.

374. Electrical Design Laboratory.

Course 7, IV Year; 2 hrs. laboratory per week, second term.

Design projects and exercises to accompany subject 373.

375. Electrical Engineering. A. J. Kravetz.

Course 10, III Year; 2 hrs. lectures per week, both terms.

Principles of d-c and a-c circuits including the more important methods of measuring resistance, current, potential difference, power and energy; the principles of operation of d-c and a-c machinery; thermionic tube characteristics and applications.

376. Electrical Engineering Laboratory.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Laboratory exercises to accompany subject 375.

377. Electric Machines. G. F. Tracy.

Course 5e, III Year; Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Operating characteristics, control, and applications of direct-current and alternating-current machines.

378. Electric Machines Laboratory.

Course 5e, III Year; Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

Laboratory exercises to accompany subject 377.

379. Electronics Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, second term.

Laboratory exercises to accompany subject 366.

GEOLOGICAL SCIENCES

380. Physical Geology. G. B. Langford.

Courses 2 and 9, I Year; Course 5g, III Year; 2 hrs. lecture per week, both terms.

An introduction to the study of geology and mineralogy.

Reference books: Principles of Physical Geology—Holmes. Elementary Geology for Canada—Moore.

381. Physical Geology Laboratory. G. B. Langford.
Courses 2 and 9, I Year; Course 5g, III Year; 2 hrs. per week-both terms.
A laboratory course to accompany subject 380.

382. Engineering Geology. A. MacLean.
Course 1, III Year; 2 hr. lecture per week, both terms.
Structural, dynamic and economic geology, with special reference to engineering problems.
Reference books: Engineering Geology—Ries and Watson. Geology and Engineering—Legget.

383. Engineering Geology Laboratory. G. B. Langford.
Course 1, III Year; 1 hr. per week, first term; 2 hrs. per week, second term.
Specimens, maps, and sections to accompany subject 382.

384. Glacial Geology. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.
Reference books: Ice Ages, Recent and Ancient—Coleman. The Last Million Years—Coleman. Physiography—Salisbury.

386. Mineralogy and Lithology. E. W. Nuffield.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. lecture per week, both terms.
A study of crystallography, descriptive and determinative mineralogy, and the common rocks.
Reference book: An Introduction to the Study of Minerals—Rogers.

387. Mineralogy and Lithology Laboratory. E. W. Nuffield.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. per week, both terms.
Practice in identifying minerals and rocks.

388. Advanced Mineralogy. E. W. Nuffield.
Course 9, IV Year; 2 hrs. per week, both terms.
Continuation of the mineralogy of subject 386.

390. Morphological Crystallography. M. A. Peacock.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.
Text book: The Form and Properties of Crystals—Dale.

391. Petrology. W. W. Moorhouse.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Microscopic character of the rock-forming minerals in thin sections, and description and classification of rocks.
Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

392. Petrography Laboratory. W. W. Moorhouse.
Course 9, III Year; 2 hrs. per week, both terms.
Microscopic petrography, to accompany subject 391.
Text books: As in subject 391.

393. Historical and Stratigraphical Geology. L. S. Russell.
Course 9, II Year; 2 hrs. lectures per week, both terms.
Course 9, III Year; 2 hrs. lectures per week, both terms (1950-51 only).
Study of the principles of stratigraphy and historical geology since Precambrian times.
Text book: Historical Geology—Schuchert and Dunbar.

394. Historical and Stratigraphical Geology Laboratory. L. S. Russell.
Course 9, II Year; 2 hrs. per week, both terms.
Course 9, III Year; 2 hrs. per week, both terms (1950-51 only).
Laboratory work to illustrate subject 393.

395. Palaeontology. M. A. Fritz.
Course 9, III Year; 2 hrs. lectures per week, both terms, starting in 1951-52.

396. Palaeontology Laboratory. M. A. Fritz.
Course 9, III Year; 2 hrs. per week, both terms, starting in 1951-52.

397. Structural Geology. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Structures caused by the deformation of the earth's crust.
Text books: Structural Geology—Billings. Field Geology—Lahee.

398. Structural Geology Laboratory. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 3 hrs. per week, both terms.
Work with geological maps of folded and faulted areas, structural sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 397.

399. Mineral Deposits. W. H. Gross.
Courses 2 and 9, III Year; Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Course 8a, IV Year; 2 hrs. lectures per week, second term.
The first term covers the metallic ore deposits and the second term the non-metallic deposits, including coal and petroleum.

400. Mineral Deposits Laboratory. W. H. Gross.
Course 9, III Year; 3 hrs. per week, both terms.

401. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

402. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. laboratory per week, second term. Accompanying subject 401.

403. Precambrian Geology. W. W. Moorhouse.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Precambrian formations of Canada—their rocks, distribution, relationships and economic features. Briefer accounts are given of similar formations in the United States and elsewhere.
Reference books: Publications of the Dominion and Provincial geological surveys. Mineral Deposits of the Canadian Shield—Bruce.

404. Precambrian Geology Laboratory. W. W. Moorhouse.
Course 9, IV Year; 3 hrs. laboratory per week, second term.
To accompany subject 403.

405. Mining Geology. G. B. Langford.
Courses 2, 5g, IV Year; 2 hrs. lectures per week, second term.
Course 9, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
A course dealing with the application of geology to mining.
Reference book: Mining Geology—McKinstry.

406. Mining Geology Laboratory. G. B. Langford.
Course 9, IV Year; 3 hrs. per week, both terms.
A laboratory course to accompany subject 405.

407. Petroleum Geology. W. M. Tovell.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
The origin, nature, and occurrence of petroleum and natural gas deposits and the extraction of these substances from the earth.

408. Petroleum Geology Laboratory. W. M. Tovell.
Course 9, IV Year; 3 hrs. per week, second term.
Accompanying subject 407.

409. Geological Excursions. A. MacLean.
Courses 2 and 9, IV Year.
During October weekly trips will be made to points of interest near Toronto.

410. Geological Field Work. G. B. Langford.
Courses 2 and 9, III Year; given at the University Survey Camp preceding the opening of the first term. Students taking this course must supply themselves with a geological pick, hand lens, and engineer's 6″ pocket scale.
Reference book: Field Geology—Lahee.

HEAT ENGINES

420. Elementary Heat Engines. F. G. Ewens, C. E. Olive, O. Clodman.

Course 3, II Year; 1 hr. lecture per week, both terms.

Course 11, II Year; 1 hr. lecture per week, both terms.

Courses 2, 8, and 9, II Year; 1 hr. lecture per week, first term.

Course 7, II Year; 1 hr. lecture per week, first term.

Course 10, II Year; 1 hr. lecture per week, first term.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcutt, P. B. Hughes, F. C. Hooper, E. J. Durand.

Course 3, III Year; 2 hrs. lectures per week, both terms.

Courses 5t and 10, III Year; 2 hrs. lectures per week, both terms.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, both terms.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Course 11, III Year, 2 hrs. lectures per week, both terms.

For each group selected topics are arranged to suit the courses included in the group.

The application of the laws of thermodynamics to ideal processes and cycles using gases and vapours. The cycles used in practice for steam and internal combustion engines, compressors and refrigerating plants. Unavailable energy and entropy. Theoretical and practical efficiencies obtainable. Heat transfer and regeneration. Tables and charts for vapours used in engineering practice.

Reference book: Elementary Engineering Thermodynamics—Young and Young.

422. Heat Engineering. R. C. Wiren.

Course 3, III Year; 2 hrs. lectures per week, both terms.

Internal Combustion Engines. Types and operation; performance and testing; basic characteristics and principles of design; carburation; fuel injection; governing.

Steam Turbines. Types and basic characteristics; condensers and auxiliaries; cooling towers.

Steam Generators and Plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces, stokers, pulverised fuel equipment, economizers, air heaters, superheaters, etc.

Air Conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidify-

ing and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Text books: Heat Engines—Allen and Bursley. Air Conditioning—Holmes.

Reference books: Internal Combustion Engines—Polson. Maleev. Jennings and Obert. Steam Turbines—Church. Elementary Heat Power—Solberg, Cromer and Spalding. Steam Power Stations—Gaffert. Air Conditioning Principles—Mackey. Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, W. A. Wallace, W. T. Thompson, F. C. Hooper.

Courses 3, 5t, and 10, III Year; 1 three-hour laboratory period per week, both terms.

Course 7, III Year; 1 three-hour laboratory period per week, first term.

Course 11, III Year; 1 three-hour laboratory period per week, second term.

The laboratory work is designed to assist in clearer understanding of theory and practical applications, and consists of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

The work on Heat Engines deals with the setting of slide valves, measuring indicated and brake horse-power, the use of power plant instruments and auxiliaries, testing of air compressors, steam engines, steam turbines and internal combustion engines under various conditions, steam calorimetry and the solution of numerous practical problems.

The Fuel Testing includes analysis of fuels and products of combustion, knock rating of gasolines, fuel calorimetry, etc.

The work on Heat Transfer deals with temperature measurement, tests on insulation and heat exchangers of various kinds.

The work on air conditioning deals with the use of instruments and charts, air conditioning standards and the solution of practical problems.

424. Heat Power Engineering. R. C. Wiren.

Courses 3 and 5t, IV Year; 2 hrs. lectures per week, both terms.

A continuation of lecture course 421 consisting of a more advanced study as applied to power plants. Properties of pure substances. Analysis and applications of the First and Second Laws. Change of phase and equations of state. Thermodynamic functions and relations as applied to a perfect gas and working fluids used in power plants. Unavailable energy and entropy. Charts and diagrams used in practice. Steam as a working fluid. Steam turbines. Power plant cycles including reciprocating engines and turbines. Cycles

for high pressures and temperatures. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies.

Reference books: Heat and Thermodynamics—Zemansky. Engineering Thermodynamics—Ebaugh. Everett. Keenan. Obert. Hawkins. Steam Power Stations—Gaffert. Steam Turbines—Church.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3 and 5t, IV Year; 1 hr. lecture per week, both terms.

The various types of internal combustion engine and their respective applications. The different cycles of operation and the avoidable and unavoidable losses. The admission, compression, combustion, expansion and exhaust operations, the factors that influence them and their application to the engine and turbine. The cooling system and its effect on thermal and mechanical conditions.

426. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper.

Course 3, IV Year; 5 hrs. laboratory work per week, both terms.

Course 5t, IV Year; 6 hrs. laboratory work per week, both terms.

A continuation and extension of the work covered in the III Year laboratory subjects consisting of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

In the Heat Engine laboratory complete tests are made of various engines such as simple, compound and uniflow steam engines, impulse and reaction type steam turbines, steam injectors, gas, oil and gasoline engines. In each case an analysis is made of the thermal cycle involved, a complete set of experiments is performed and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Problems involving variable specific heat are studied.

In the Fuel Testing laboratory the octane rating of gasoline samples is determined by A.S.T.M. methods and fuel injection spray characteristics are studied with special test equipment.

In the Heat Transfer laboratory tests are made on heat exchangers.

In the Air Conditioning and Refrigeration laboratory tests are performed on complete air conditioning systems, and complete refrigerating plants.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 8, III Year; Course 2, IV Year; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

Reference books: Elementary Engineering Thermodynamics—Young and Young. Engineering Thermodynamics—Ebaugh. Theory and Practice of Heat Engines—Faires.

428. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8, III Year; 1½ hrs. laboratory per week, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course St, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, D. G. Huber, W. J. Laari, H. M. MacFarlane.

Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes, open channel computations; with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; one 3-hr. laboratory period per week, second term.

Course 6, III Year; one 3-hr. laboratory period per week, first term.

Course 2, III Year; six 3-hr. laboratory periods, first term.

Course 8a, IV Year; one 3-hr. laboratory period per week, first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. Much of the work is done by the process of arithmetic integration, and the lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc., are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3- and 2-hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomenon and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a

general discussion of pumps. Turbines and water power developments.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber, W. Laari.

Course 1, IV Year; one 3-hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. L. E. Jones, W. Laari, H. M. McFarlane, G. Simonson.

Courses 1, 3, 6, 7, 8, 8a, and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure-density-height relationships. Measurement of pressure intensity. Fluid thrust on submerged surfaces. Buoyancy and flotation.

Text book: Elementary Fluid Mechanics—Vennard.

448. Mechanical and Thermal Measurements. L. E. Jones, E. H. Dudgeon.

Courses 2, 3, 6, 7, 9, and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities, and means of measuring them. Dimensions, units, standards, length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 2 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analysing technical data; elements of curve-fitting and statistical treatment.

450. Hydraulics. D. G. Huber.

Course 5t, III Year; 1 hr. lecture per week, both terms.

A course emphasizing the fundamentals of fluid flow in pipes with special reference to refrigeration problems and including discussion of pumps.

Reference books: Elementary Fluid Mechanics—Vennard. Centrifugal Pumps and Blowers—Church. Refrigerating Data Book.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. A. B. Carr.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

Text book: Aircraft Hydraulics—Adams.

MACHINERY

461. Mechanical Engineering. J. W. Church.

Course 3, II Year; 2 hrs. lectures per week, first term.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

462. Elementary Machine Design. W. G. McIntosh, R. T. Waines.

Courses 6 and 7, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machining, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design (involving material applications and calculation of stresses) and selection of various machine elements with particular application to power transmission (belting, shafting and gearing), fastening screws, power screws and wire rope.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory will illustrate the lecture subject.

465. Theory of Machines A. I. W. Smith, W. E. Morley.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical application. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams.

Text book: Mechanism—Prageman.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Text book: Vibration; Mechanical Vibrations—Thomson.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, III Year; an average of 7 hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Course II, III Year; 3 hrs. laboratory per week, both terms.

Design laboratory work will be taken by students in all courses listed above. This will involve the design of machine elements with the object of illustrating the work covered in the lecture subjects in Machine Design. Sketching and drafting will be given with a view to developing the student's judgment and sense of proportion in design and the application of drafting room standards.

Mechanics of Machinery laboratory work will be taken by Course 3 only. This will include the analytical and graphical solution of problems dealing with inertia loads and stresses and the determination of speed fluctuation.

Mechanical laboratory work will be taken by Courses 3 and 10. This will include selected experiments in speed measurement, oil testing, balancing, testing of power drives, etc.

Machine and Welding Shops laboratory work will be taken by all groups. This will take the form of demonstrations of equipment in these shops with a view to assisting students in the visualization of manufacturing methods employed for parts being designed.

469. Machine Design. R. T. Waines, J. W. Church.

Courses 2, 6, 8, and 8a, IV Year; 1 hr. lecture per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6, 8, and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. W. E. Morley.

Course 5, III Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. E. Morley.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

This is a continuation of Subjects 467 and 466. It will involve the design of various machine elements and equipment including machine frames, hooks, hoisting equipment, crankshafts, gears (helical, herringbone, bevel, screw, and worm), springs, clutches, brakes, thin and thick wall vessels.

An introduction will be given to the study of vibration problems encountered in high speed engines and machines.

Text book: Design of Machine Elements—Faires.

474. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines, W. E. Morley.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Advanced laboratory work involves both analysis and design of machine elements, machine units, and complete machines. The selection of problems is made with a view to giving the student as broad a coverage as possible and providing experience in combining of elements to form a machine of smooth and harmonious design. Some of this work will involve special shafting problems including graphical solutions, critical speeds, and multiple supports.

Work will be given in the Mechanical Laboratory on gauging and fine measurements, experimental stress analysis, vibration, and bearing testing.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Spotts.

476. Manufacturing Processes. J. W. Church.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

477. Manufacturing Processes Laboratory. J. W. Church.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

478. Machine Design. W. E. Morley.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

A series of lectures intended to supplement subject 471 of the Third Year, while co-ordinating with the Fourth Year thermodynamic subjects, by presenting the overall approach employed in the design of simple power units.

MATHEMATICS

490. Calculus. I. R. Pounder, G. Berman, C. Kassimatis, J. M. Kennedy, R. G. Stanton.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 2 hrs. lectures per week, both terms.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

491. Calculus. J. D. Burk, G. de B. Robinson, G. E. N. Fox, H. S. Heaps.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289.

492. Analytical Geometry. I. R. Pounder, G. Berman, G. M. Petersen, J. M. Kennedy, R. G. Stanton.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate the general methods of analytical geometry. Introduction to Analytical Geometry of Three Dimensions. In addition, problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

494. Least Squares. O. J. Marshall.

Course 1, II Year; 1 hr. lecture and 2 hrs. laboratory per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulæ.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes.

495. Mathematical Problems. W. J. Webber, D. A. F. Robinson, C. Kassimatis, A. E. Schreidigger.

Courses 5 and 10, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. W. J. R. Crosby.

Courses 5 and 10, I Year; 3½ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books: Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. W. J. R. Crosby.

Courses 5 and 10, I Year; $1\frac{1}{2}$ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. C. Kassimatis.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger, R. A. Jenkins.

Course 1, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, linear equations of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorf, and Pohlhausen.

509. Differential Equations. J. D. Burk, D. A. F. Robinson.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. A. J. Coleman.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. F. Stevenson.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

METALLURGY

530. Metallurgy. L. M. Pidgeon, B. Chalmers.

Course 8, II Year; 1 hr. lecture per week, both terms.

Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations, and principles of physical metallurgy.

531. Fuels and Combustion. H. U. Ross.
Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.
Fuels, their use, preparation, calorific value, and combustion.

532. Physical Metallurgy I. B. Chalmers, B. M. Thall.
Course 11, II Year; Course 3, III Year; 1 hr. lecture per week, both terms.
A general course in Physical Metallurgy, dealing with the structure of metals and alloys, with special reference to the ferrous and non-ferrous alloys of practical importance. The influence of mechanical deformation, heat treatment and composition on the structure is considered, and the relation between the structure and the mechanical properties is examined.

534. Metallurgy. L. M. Pidgeon.
Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A general discussion of the fundamental principles of extractive metallurgy, including the production of the more important metals.
Metallurgical problems are included in this course.

535. Metallurgy Laboratory. H. U. Ross.
Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.
Experiments in roasting, smelting, leaching, and retorting designed to illustrate the principles underlying these operations.

536. Principles of Physical Metallurgy. B. Chalmers.
Course 8, III Year; 2 hrs. lectures per week, both terms.
One hour lecture per week in first term consists of a series of lectures on the structure of solids, with particular reference to x-ray methods of investigation.

537. Physical Metallurgy Laboratory. B. Chalmers, B. M. Thall.
Course 8, III Year; 3 hrs. laboratory per week, both terms.
Practical work relating to subject 536.

538. Metallurgy. L. M. Pidgeon.
Course 2, IV Year; 1 hr. lecture per week, both terms.
The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes.

539. Metallurgy Laboratory. H. U. Ross.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgy Problems. L. M. Pidgeon, H. U. Ross.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Problems of chemical reactions, thermochemistry, electrolysis, vapor pressure, transmission of heat, etc.

541. Metallurgy Laboratory. H. U. Ross.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term.
Metallurgical analysis of ores, furnace products, and alloys.

542. Non-Ferrous Production Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Extractive metallurgy of the non-ferrous metals, including electrometallurgy.

543. Physical Metallurgy. B. Chalmers.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536.

544. Physical Metallurgy Laboratory. B. Chalmers, B. M. Thall.
Course 8, IV Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practical work relating to subject 543.

546. Physical Metallurgy. B. Chalmers, B. M. Thall.
Course 1, III Year; 1 hr. lecture per week, first term.
A short course on the influence of heat and mechanical treatment on the structure and properties of steels and the more important non-ferrous alloy.

547. Physical Metallurgy 2. B. Chalmers, B. M. Thall.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 532.

548. Physical Metallurgy. Laboratory. B. Chalmers,, B. M. Thall.
Courses 3 and 11, IV Year, 1½ hrs. laboratory per week, second term.
A practical course illustrating the principles dealt with in subjects 532 and 547.

549. Physical Metallurgy B. Chalmers., B. M. Thall.
Course 5, 7, and 8a, III Year; Courses 2, 9, and 10, IV Year; 1 hr. lecture per week, both terms.
A short course in Physical Metallurgy; stucture of metals and alloys; effects of mechanical distortion and heat treatment on structure; relation between structure and mechanical properties; and properties of some steels and non-ferrous alloys.

550. Metallurgical Theory. W. C. Macdonald.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

552. Ferrous Production Metallurgy. H. U. Ross.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Production metallurgy of iron and steel.

CERAMICS

560. Ceramic Minerals and Calculations. P. M. Corbett, B. Chalmers.

Course 8a, III Year; 4 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.

Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term. One hour per week first term to be devoted to a joint lecture with subject 536 on structure of solids.

561. Heavy Clay Products Laboratory. P. M. Corbett.

Course 8a, III Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. P. M. Corbett.

Course 8a, III Year; 2 hrs. lectures per week, second term.

The composition of clear and coloured glazes.

564. Ceramics Laboratory. J. E. Toomer.

Course 8a, III Year; 6 hrs. laboratory per week, both terms.

Practice in the analysis of non-metallic minerals.

565. Refractories and Ceramic Bodies. P. M. Corbett.

Course 8a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. P. M. Corbett.

Course 8a, IV Year; 1 hr. lecture per week, both terms.

Composition and manufacture of glass and iron enamels.

568. Whitewares and Enamels Laboratory. P. M. Corbett.

Course 8a, IV Year; 6 hrs. laboratory per week, both terms.

Advanced work on the compounding and testing of non-metallic mineral products.

573. Refractories in Metallurgy. P. M. Corbett.

Course 8, III Year; 1 hr. lecture per week, both terms.

Theories and applications of refractories in metallurgical processes.

MODERN LANGUAGES

610. English. W. J. T. Wright.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 1 hr. lecture per week, both terms.

The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading.

613. German. T. Hedman.

Course 6, I Year; 2 hrs. lectures per week, both terms.

614. German. T. Hedman.

Course 6, II Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German.

PHYSICAL TRAINING

640. Physical Training.

All courses, I and II Years.

The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. J. Satterly.

Courses 5, 8, 8a, and 10, I Year; 4 hrs. lectures per week, both terms.

In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.

Reference books: Dynamics—Duncan and Starling. Mechanics of Fluids—Barton. Mechanics—Sears. Properties of Matter—Wagstaff. Heat—Stewart and Satterly (ed. Archer). Heat—Noakes. Mathematical and Physical Tables—Clark. Calculus Made Easy—Thompson. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. J. Satterly.

Courses 5, 8, 8a, and 10, I Year; 3 hrs. laboratory per week, both terms.

Supplementary to subject 650.

652. Elementary Magnetism and Electricity. D. S. Ainslie.

Courses 5, 8, 8a, and 10, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.

Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.

Courses 5, 8, 8a, and 10, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics.

Courses 5, 8, 8a, and 10, II Year; 1 hr. lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655. Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5, II Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Courses 8, 8a, and 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Mathematical Methods in Physics I. H. L. Welsh.

Course 5, III Year; 1 hr. lecture per week, both terms.

Analysis of scalar and vector fields with applications to mechanics and hydromechanics. Complex numbers and their use in two-dimensional theory of fields and in problems of mechanical vibrations.

657. Properties of Matter. John Satterly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Advanced work on properties of matter, dealing with gravitation, elasticity, viscosity, surface tension, and kinetic theory of gases.

Reference books: Properties of Matter—Poynting and Thomson. General Properties of Matter—Newman and Searle. Applied Mathematics—Perry. Experimental Physics—Searle. Practical Physics—Watson. The Mechanical Properties of Fluids—Drysdale and others.

658. Heat. John Satterly.

Course 5, III Year; 1 hr. lecture per week, both terms.

Thermometry and pyrometry; absolute scale of temperature, mechanical equivalent of heat, kinetic theory of gases, equations of state, low temperature work, specific heats, vaporization, fusion, expansion, transfer of heat by conduction and convection; radiation and radiation pyrometry, the second law of thermodynamics and its simple applications.

Reference books: Heat and Thermodynamics—Roberts. Methods of Measuring Temperature—E. Griffiths. A Textbook on Heat. Parts I and II—Allen and Maxwell.

659. Physical Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term.

Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, H. J. C. Ireton, H. L. Welsh.

Courses 5e, 5i, and 5s, IV Year; 2 hrs. lectures per week, both terms.

Introduction to quantum theory, atomic, molecular and nuclear physics.

Text books: Introduction to Modern Physics—Richtmyer and Kennard. The 'Particles' of Modern Physics—Stranathan.

664. Mathematical Methods in Physics II. C. Barnes.

Courses 5e, 5s, and 5i, IV Year; 2 hrs. lectures per week, both terms.

Vibrations of systems of one and two degrees of freedom. Formulation of general laws of fluid motion, elasticity, wave propagation, and heat conduction. Application of function theory, Cartesian tensors, and calculus of variations in classical problems.

665. Physical Laboratory. H. J. C. Ireton.

Course 5s, IV Year; 9 hrs. laboratory per week, both terms.

Accompanying the lecture subjects 663, 666, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 2 hrs. lectures per week, second term.

Diffraction, interference, and polarisation.

Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams. Cours d'Optique—Bruhat.

667. Theory of Potential. C. Barnes.

Course 5e, III Year; 1 hr. lecture per week, both terms.

The theory of the Newtonian potential leading to the solution of simple boundary-value problems connected with the Laplace equation in gravitation, electrostatics, and heat conduction.

669. Analysis of Materials by Spectrographic and X-Ray Methods. H. J. C. Ireton.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. A. A. Brant, G. D. Garland.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. A. A. Brant, G. D. Garland.

Course 9, IV Year; 1 hr. lecture per week, both terms.

Elementary physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. A. A. Brant, G. D. Garland.

Course 5g, IV Year; 6 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 670.

673. Geophysics. A. A. Brant, G. D. Garland.

Course 9, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.

Course 5i, IV Year; 3 hrs. laboratory per week, both terms.

Accompanying subject 663.

675. Physics of the Earth. J. T. Wilson, G. D. Garland.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

PRACTICAL EXPERIENCE

690. Practical Experience.

Course 1.

Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present

satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.

Course 2.

Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the students in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 1200 hours' experience in work connected with engineering practice. Certificate forms may be obtained from the Department of Electrical Engineering and the completed certificates should be returned to the Department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development, underground work or service on geological field parties, and at least half of the time should be spent underground.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, O. J. Marshall, T. L. Rowe, H. L. Macklin, B. J. Haynes, W. H. Carr.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the chain, the transit, and the level, with special attention given to co-ordinative surveying.

Text books: Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed. Printed Notes on Elementary Surveying—The Staff in Surveying.

712. Field Work. W. M. Treadgold, O. J. Marshall, T. L. Rowe, H. L. Macklin, B. J. Haynes, W. H. Carr.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; a complete survey of a piece of land with the chain and transit; keeping of field notes; the use of the transit in surveying closed figures and traverse lines, and in ranging straight lines; plotting by latitudes and departures and otherwise computing areas; instrumental work with the level; use of level and transit in setting out a proposed building and calculating the volume of excavations required.

714. Surveying. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, compound and spiral curves as applied to highway and railroad surveying. Main features of mine and hydrographic surveying.

Text books: Railroad Curves and Earthwork (with Tables)—Allen. Printed Lecture Notes.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, O. J. Marshall, B. J. Haynes, W. H. Carr.

Course 1, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and curves.

717. Field Work. H. L. Macklin, B. J. Haynes.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling, curves and topography.

718. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 1 hr. lecture per week, both terms.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

Text books: Field Engineering—Searles. Railroad Curves and Earthwork—Allen. Route Surveying—Pickles and Wiley. Printed Notes—W. M. Treadgold.

719. Geodesy and Map Projections. O. J. Marshall.

West Indies Surveyors; 1 hr. lecture and 2 hrs. laboratory per week, second term.

Elementary geodesy, figure of the earth, spherical excess, etc. Computation of geographic position and plane co-ordinates on typical systems of map projections.

720. Survey Camp. W. M. Treadgold, O. J. Marshall, J. W. Melson, T. L. Rowe, H. L. Macklin, B. J. Haynes, W. H. Carr, G. B. Langford, W. W. Moorhouse.

Courses 1, 2, and 9, III Year.

Course 1. . . . . .Aug. 14 to Sept. 15—Dorset.

Courses 2 and 9. . . . .Aug. 14 to Sept. 15—Gull Lake.

Course 1:

(*a*) Secondary Triangulation and Base Line Measurements.

(*b*) Highway and Railway Location.

(*c*) Cross Sectioning and Computation of Earthwork.

(*d*) Stadia and Plane Table Topography.

(*e*) Observations for Time, Azimuth, and Latitude.

Courses 2 and 9:

(*a*) Stadia and Plane Table Topography.

(*b*) Mine Surveying, using overhead stations.

(*c*) Shaft plumbing and use of Auxiliary Telescope.

(*d*) Geological Surveying and mapping.

Students in Courses 1, 2, and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year; 2 hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instruc-

tions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis Seminar.

Course 5, IV Year.

Each student in the Fourth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training for those fields.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, first term.

Each student must collect suites of rocks and minerals or fossils during the summer vacation preceding the IV Year. This material must be identified and described during the first term, and the report covering this work must be submitted by January 15th of the IV Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course 11, IV Year.

Each student in the Fourth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work in each subject is 50% and a student must obtain a weighted average of 60% in order to pass in the work of the year. He shall be required to pass a supplemental examination in each subject in which he obtains less than 50%. Subjects will be weighted according to the number of hours devoted to them, the hours assigned to laboratory subjects being given one half the weight of those in lecture subjects.

5. Honours and scholarships will be awarded upon the basis of the weighted average.

6. Honours will be awarded to a student, who at the Annual Examinations passes in all written and laboratory subjects and who also obtains a weighted average of 75% on the work of the year.

7. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

8. A student who fails in the work of any year, provided he is otherwise eligible, will be permitted to register provisionally for the purpose of repeating the year.

9. If the performance of a student repeating the First Year is unsatisfactory during the first term, as determined by laboratory marks and written examinations, he may be required to withdraw.

10. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

11. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they failed before presenting themselves a second time for examination.

12. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

13. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

14. A student who has failed to complete satisfactorily the course in Physical Education prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Education prescribed for the Second Year will not be permitted to register in the Fourth Year.

15. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 28th day of August, 1950. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by the order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. MEDALS, PRIZES, SCHOLARSHIPS, BURSARIES AND FELLOWSHIPS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

In order to be eligible for a medal, prize, scholarship, bursary, fellow ship or other awards granted solely upon standing obtained at an annual or special examination or upon an essay, or term work, or other academic rating, a candidate must obtain honours at such annual or special examination or upon such essay, term work, or other academic rating unless the statute respecting the award or medal specifies that standing lower than honours may be accepted.

When an award or medal is granted upon standing obtained on part of the work of any academic year the candidate must obtain standing but need not obtain honours in the work of the academic year as a whole, provided he obtains honours in the part concerned, unless the statute respecting the award or medal specifies otherwise.

No medal, prize, scholarship, bursary, fellowship or other award will be granted to a candidate who is conditioned in any subject at an annual examination or in Physical Education unless the statute respecting the award or medal specifies otherwise.

A candidate will not be permitted to receive more than one award in a session unless the statute establishing each of the awards concerned or the Calendar specifies otherwise. Only one of those marked by an asterisk may be held in any one year. A candidate who would, but for this provision, have received more than one award may have his name so published in the class lists.

A candidate who has spent two sessions in any year of an undergraduate course is not eligible to compete for any award at the annual examinations of that year.

Medals, after they have been suitably engraved, will be given without delay to the winners or forwarded to them by registered mail.

Awards granted to members of graduating classes other than awards for graduate study and research, will be paid in one instalment as soon as possible after the granting of the awards.

All other awards will be paid (i) if of the value of $50 or less, in one instalment on November 20 and (ii) if of the value of more than $50 in two equal instalments, the first on November 20 and the second on February 20, in the session following the granting of the awards provided that no payment is made to a candidate (*a*) who is not in regular attendance upon lectures and laboratory classes in the Faculty, or if the Calendar so specifies, in the course in which the award is established or granted (*b*) who does not present at the Chief Accountant's Office before each payment a certificate of attendance upon lecture and laboratory classes signed by two senior members of the staff.

The Senate may, on the recommendation of the Faculty, permit a candidate to whom an award has been granted to postpone attendance upon lectures and laboratory classes for one year. Further postponement may be permitted on application.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries.....	$2000	Yes	No	145
Hagarty Memorial Scholarship	$60	Yes	Yes	145
U.T.S. Engineering Scholarship	$250	Yes	Yes	146
The Leonard Foundation Scholarships..............	—	Yes	Yes	146
The Robert Simpson Company Scholarship...............	$100	Yes	Yes	146
O.H.A. War Memorial Scholarship...............	$200	Yes	Yes	147
Engineering Alumni Admission Scholarship...............	$300	Yes	No	147
Students' Administrative Council Admission Scholarship...	$350	Yes	Yes	147

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	148
*Baptie Scholarship...........	—	No	Yes	148
MacLennan-MacLeod Memorial Prize..............	—	No	No	148
*Ransom Scholarship in Chemical Engineering............	$150	No	Yes	149
T. H. Bickle Prize...........	$30	No	Yes	149
*John M. Empey Scholarship..	$100	No	No	150
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics.......	$60	No	Yes	150
*Wallberg Undergraduate Scholarships..............	$600	No	No	150
*Association of Professional Engineers of the Prov. of Ontario Scholarships.......	$225	No	Yes	153
Hugh Gall Award...........	$100	Yes	No	150
University Naval Training Division Bursaries.........	$100	Yes	Yes	151
S. Ubukata Fund............	—	Yes	Yes	152
*Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	151
University of Toronto General Bursaries.................	—	Yes	No	166
Dominion-Provincial Student-Bursaries.................	—	Yes	No	166
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship..........	£400	Yes	No	159
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	148
*Harvey Aggett Memorial Scholarship...............	$75	No	No	152
J. A. Findlay Scholarship.....	—	No	Yes	152

Name	Amount	Application required	Available only to a limited group or single course	See page
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$175	No	Yes	153
T. H. Bickle Prize...........	$30	No	Yes	149
Women's Mining Association Scholarship...............	$300	Yes	Yes	153
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships.............	—	No	Yes	154
*John M. Empey Scholarship..	$100	No	No	150
W. G. Millar Memorial Scholarship...............	$250	Yes	Yes	154
*Wallberg Undergraduate Scholarships.............	$300	No	No	150
Ardagh Prize................	$50	No	Yes	155
*Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	151
James L. Morris Memorial Prize	$60	No	Yes	155
University of Toronto General Bursaries.................	—	Yes	No	166
Dominion-Provincial Student-Aid Bursaries.............	—	Yes	No	166
Scottish Rite Masons Bursary.	$100	Yes	Yes	151
Eastern Steel Products Limited Scholarship..............	$350	Yes	Yes	155
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship..........	£400	Yes	No	159
*Boiler Inspection and Insurance Company Scholarship......	$150	No	Yes	156
University Alumni Federation War Memorial Scholarships.	$250	Yes	No	148
*Jenkins Scholarship in Engineering...............	$200	No	No	156
Heating and Ventilating Engineers Prize................	$25	No	No	156
E.I.C. Prize.................	$25	No	Yes	157
Engineering Society Semi-Centennial Award..........	$75	No	No	157
J. A. Findlay Scholarship.....	—	No	Yes	152
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$225	No	Yes	153

Name	Amount	Application required	Available only to a limited group or single course	See page
T. H. Bickle Prize...........	$30	No	Yes	149
Women's Mining Association Bursary..................	$150	Yes	Yes	153
Archie B. Crealock Memorial Prize.....................	$25	No	Yes	157
*John M. Empey Scholarship. .	$100	No	No	150
Hudson Bay Mining and Smelting Company Limited Scholarships..............	$800	Yes	Yes	157
*Wallberg Undergraduate Scholarships..............	$300	No	No	150
*Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	151
Chemical Institute of Canada Prize.....................	$25	No	Yes	157
Kennecott Copper Corporation Scholarship...............	$750	No	Yes	158
University of Toronto General Bursaries.................	—	Yes	No	166
Dominion-Provincial Student-Aid Bursaries.............	—	Yes	No	166
Available to Students Completing the Fourth Year	—			
B.A.A.S. Medal.............		No	No	158
Heating and Ventilating Engineers Prize................	$25	No	No	156
INCO. Scholarship..........	$500	Yes	Yes	158
"Second Mile Engineer" Award	$100	No	Yes	158
Henry G. Acres Medal.......	—	No	Yes	159
University of Toronto General Bursaries.................	—	Yes	No	166
Dominion-Provincial Student-Aid Bursaries.............	—	Yes	No	166
Available to Graduates				
Rhodes Scholarship..........	£400	Yes	No	159
1851 Exhibition Science Research Scholarships........	£275	Yes	Yes	160

Name	Amount	Application required	Available only to a limited group or single course	See page
McCharles Prize.............	$1000	No	No	161
Nipissing Mining Research Fellowships...............	$1100	Yes	No	162
H. W. Price Research Fellowship in Electrical Engineering.....................	—	Yes	Yes	162
C.I.L. Fellowship in Chemistry	$750	Yes	Yes	162
T. A. Russell Memorial Research Fellowship..........	$1000	Yes	Yes	163
Consolidated Mining and Smelting Company Fellowship...	$750	Yes	No	163
Canadian Institute of Steel Construction Research Fellowship................	$1200	Yes	No	163
Canadian Lumbermen's Association Timber Research Fellowship................	$1000	Yes	No	163
Imperial Oil Graduate Research Fellowships.........	$4000	Yes	Yes	164
Wallberg Research Fellowships	$3000	Yes	No	164
Spruce Falls Power and Paper Company Limited Fellowships	$750	Yes	No	164
Algoma Ore Properties Limited Graduate Fellowships......	$2200	Yes	Yes	165
1940 Toronto Fund..........	—	Yes	No	165
Raymond Priestley Fellowship	£450	Yes	No	165
Royal Institution of Great Britain Science Research Scholarships..............	£350	Yes	No	166

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

In those cases where the amount of the award is not payable from income earned on an endowed fund, payment will be dependent on the receipt of the amount of the annual award from the donor.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $200, will be awarded in 1950 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1950. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship

was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School, the Kapuskasing High School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute and Vocational School, from whom further information may be obtained regarding conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidate shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidate shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities

of North Bay, Sudbury, Sault Ste. Marie, Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, in the School of Architecture, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent. at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Eight scholarships and awards, each of the value of $200.00 will be granted in 1950-51 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of financial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first

Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards listed in the Calendar with an asterisk. The awards were first made on the result of the annual examination of 1947.

HUGH GALL AWARD

The Hugh Gall Award, of the value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions,

has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session. A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

THE SCOTTISH RITE MASONS' BURSARY

The Scottish Rite Masons' Bursary, the gift of the Scottish Rite Masons of Toronto, of the value of $100. is awarded to a student enrolled in the Second Year who is a member of the Masonic Order, or a son, brother, nephew, daughter, sister or niece of a member of the Masonic Order. Consideration will be given to financial need and academic standing. Evidence of connection with the Masonic Order and information regarding financial need must be given with the application which must be submitted to the Secretary of the Faculty.

ALGOMA ORE PROPERTIES LIMITED UNDERGRADUATE SCHOLARSHIPS

Through the generosity of Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, a number of Scholarships are available to students in Mining Engineering, Metallurgical Engineering, and Mining Geology, each of a value of $600.00. On the results of the annual examinations for the Sessions indicated below, the following scholarships will be awarded:

Session 1950-51

II Year—One Scholarship of Six Hundred Dollars.

III Year—One Scholarship of Six Hundred Dollars.

Session 1951-52

III Year—One Scholarships of Six Hundred Dollars.

It is the intention that a student having once won a scholarship on the results of the Annual Examinations should continue to hold it, provided he obtains Honours in his work in subsequent years.

The holders of any of these scholarships may not hold other scholarships in the same session.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one

of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering:—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars and Seventy-five Dollars, respectively, to the two students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

THE WOMEN'S MINING ASSOCIATION BURSARY

The Women's Mining Association has presented a Bursary having the value of Three Hundred Dollars annually, commencing 1939. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. McKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Department of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endownment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course of Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00 is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examination of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris, C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income from $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the Examinations of the Second Year.

EASTERN STEEL PRODUCTS LIMITED SCHOLARSHIP

The Eastern Steel Products Limited Scholarship of an annual value of $350.00 has been established in the course in Mechanical Engineering for a period of five years.

The Scholarship will be awarded to a student entering the Third Year in Mechanical Engineering who:

(*a*) was registered in the course in Mechanical Engineering in this Faculty in his First and Second Years.

(*b*) obtained Honours in the work of the First and also of the Second Year.

(*c*) gives evidence not only of mental capacity but who also shows leadership ability, and gives promise of becoming a worth while influence in affairs of the profession and the community.

Consideration is given to financial need.

Application must be made to the Secretary of the Faculty not later than March 15.

The first award was made at the Annual Examinations of 1948.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Chief Accountant to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Course in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical

Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

KENNECOTT COPPER CORPORATION SCHOLARSHIP

The Kennecott Copper Corporation offers a scholarship of a value of $750.00 annually to a student who has completed three years of the course in Mining Engineering or, in an exceptional case, to a graduate student proceeding to the Degree of Master of Applied Science in Mining Engineering. The award will be made on the following basis.

(*a*) proficiency in engineering studies.
(*b*) leadership, willingness, co-operativeness, initiative and ambition.
(*c*) ability to direct and stimulate others and to command their respect.
(*d*) good health and physique.

The first award was available in 1948.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgy Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the

confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special enphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power developments at Shipshaw on the Saguenay River, which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer for award in the Province of Ontario two out of ten of the Rhodes Scholarships for Canadians, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year given conditionally at Oxford or elsewhere abroad may be authorized in proper cases.

Each candidate must be a British subject with at least five years domicile in Canada and unmarried; he must have passed his nineteenth

but not his twenty-fifth birthday on October 1st of the year *for* which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

A candidate may apply either for the province in which he has his private home or residence, or for the province in which he has taken his university course.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., K.C., 5 Rosedale Road, Toronto 5, General Secretary for the Rhodes Scholarships in Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey or the appropriate provincial secretary on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly

required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be ineligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Dean MacFarlane, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

MCCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in

any useful practical line. The following conditions determine the method of award.

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time as recommended by the School of Engineering Research, to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $1,000.00 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $750.00 for a research related to non-ferrous metals, heavy chemicals, and fertilizers. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Institute of Steel Construction, is offered to encourage scientific research in steel construction. It is open to honour graduates in engineering of any recognized university. The holder of the fellowship must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a programme of study and research prescribed by the School of Graduate Studies. The annual value of the fellowship is not less than $750 for a seven months term and not more than $1,200 for a ten months term.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his engineering experience.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four Graduate Research Fellowships now having a potential value of $3,750.00 each ($1,250.00 a year payable in Canadian funds for a maximum of three years). The fellowships are open to graduates of any approved University in Canada and are offered for graduate study leading to a Master's or Doctor's degree in the fields of Chemistry and/or Engineering (two fellowships), Geology (one fellowship), and Economics or Industrial Relations (one fellowship). Nomination of students for the fellowships is made by the University—such nominations to be received by Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st of each year. Nomination forms and information as to the terms of the fellowships are obtainable at the Registrar's Office.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships of the value of $1,500 each are open to graduates of any recognized university who propose to pursue advanced study and research in any branch of Engineering in the University of Toronto.

Forms of application may be obtained from the Secretary of the School of Graduate Studies. These should be returned together with a transcript of academic record and an outline of the proposed study and research not later than March 1st.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIPS

The James Herbert White Fellowship in Forestry, the Robert W. Lyons Fellowship in Forestry, the Cola G. Parker Fellowship in Forestry, the Charles H. Sage Fellowship in Applied Science, the Egerton S. Noble Fellowship in Applied Science, and the Arthur Hayes Sulzberger Fellowship in Applied Science, each the gift of the Spruce Falls Power and Paper Company, Limited, are established for the encouragement of research in the Faculties of Applied Science and Engineering and of Forestry. They are open to graduates of the University of Toronto and of other recognized universities, but are restricted to Canadian citizens.

The value of each Fellowship is up to $750. Application, together with a transcript of his academic record and an outline of the advanced study and research which he proposes to undertake, should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

ALGOMA ORE PROPERTIES LIMITED GRADUATE FELLOWSHIPS

Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, has provided the funds to establish two Graduate Fellowships of a value of $2,200.00 each to be available in the Session 1950-51 or later. In awarding the fellowships, in so far as practicable, they will be given to those who have enjoyed Algoma Ore Properties Limited Undergraduate Scholarships, and who have maintained their high academic performance. They will be given only for graduate work in Mining Engineering, Metallurgical Engineering, or Mining Geology, in the University of Toronto.

THE UNIVERSITY OF MANCHESTER TORONTO FUND

The University of Manchester has accepted the gift of a sum of £1,699 from a Committee representing the parents of children who during the war were evacuated to Toronto and other places in Canada. The capital and any income arising therefrom will be used to make grants to Canadians wishing to conduct post-graduate studies and/or research in the University of Manchester, preference being given to students who have graduated from the University of Toronto. The total amount of grant or grants to any student will not exceed £100. Applications must be submitted to the Registrar of the University of Toronto on or before January 1st of the year in which the applicant wishes to enter the University of Manchester, together with transcripts of undergraduate and graduate record and outlines of the post-graduate studies and/or research to be followed at the University of Manchester.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond

Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham. The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. To be eligible, students must have obtained not less than sixty-six per cent. at their last annual examination. Further information may be obtained from the Secretary of the Faculty.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty.

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminar courses, and private studies intended for advanced students engaged in research work. The University Library maintains also reserved book reading-rooms in University College and in the Economics Building.

During term the hours, except on Sundays and holidays, are:

University Library	8.45 a.m. to 10.00 p.m. (6 p.m. on Saturdays)
University College reading-room	8.45 a.m. to 10.00 p.m. (12.30 p.m. on Saturdays)
Reading Room, Economics building	9.00 a.m. to 5.00 p.m. (12.00 noon on Saturdays)

During the Summer vacation, the Library building is open from 9 a.m. to 4 p.m. (except on Saturdays and Sundays); and the two reading-rooms are closed.

Books in general demand may not be taken out of the Library until 3 p.m., when they are lent for the night, to be returned by ten o'clock the following morning. On Friday afternoons, these books are lent for the week-end. Books in the main library not in general demand may, on application, be borrowed for a longer period.

Many of the departments of the University, especially those that maintain laboratories or are at some distance from the University Library, have "departmental libraries"; but these, though authorized by the Library Committee of the University, are under departmental control, and books from the main Library are transferred to them at the discretion of the Librarian of the University. The regulations governing the use of books in the departmental libraries, and the hours when they are open, are determined in each case by the department concerned, and vary greatly from one department to another. Transfer of a particular book to one of these libraries is indicated in the public catalogue in the main Library.

In the University Library students of the humanities possess an extensive laboratory. It is not only a storehouse, but a workshop in which selected materials are indexed and arranged so as to be useful. The Library does not attempt to supply textbooks; but for general and specialized reading it possesses more than half a million volumes. It subscribes to about four thousand periodicals, and is a Canadian depository for United Nations publications.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical, Engineering, Mechanical, Mining and Wallberg Buildings for convenient reference.

These departmental libraries are situated as follows:

Applied Physics	Room 22, Engineering Bldg.
Chemical Engineering	Room 2001, Wallberg Bldg.
Civil Engineering	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering	Room 25, Electrical Bldg.
Geological Sciences	Room 74, Mining Bldg.
Mechanical Engineering	Room 135, Mechanical Bldg.
Metallurgical Engineering	Room 37, Mining Bldg.
Mining Engineering	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment for the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit

machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle 400,000-℔. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 ft. in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-℔. screw power universal testing machine, taking beams 18 ft. in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-℔. screw power universal testing machine, a Riehle 20,000-℔. screw power universal testing machine, an Olsen 20,000-℔. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-℔. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-℔. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-℔. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-℔. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure—apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

During 1931 the building containing these laboratories was entirely rebuilt and greatly enlarged. The new building is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part

of the third are occupied by the assaying laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storerooms.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similiarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated-pier.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORY

The main Ore Dressing laboratory, 72 ft. x 53 ft. x 22 ft. high, is equipped with the old five stamp battery with amalgamation plates,

Wilfley table, Deister Plato table, Deister slime table, an old-fashioned buddle, and classifiers. Parallel with the stamp mill is a ball mill 30 in. x 24 in., which can be used alternatively with the stamps in connection with the concentrating tables. At one side of this main laboratory is apparatus representing the complete flow-sheet of a modern concentrator designed for continuous operation at the rate of 50 to 100 lb. per hour. This plant consists of feeders, two rod mills and a ball mill each 18 in. x 12 in., with classifiers, two Wilfley tables, a Dorr type thickener, a six-cell Fahrenwald Sub A flotation unit, a conditioner, a small pilot Wilfley table, and a Genter thickener. Another laboratory, 70 ft. x 25 ft., is set aside for batch work, and contains a variety of flotation machines, small ball and rod mills, small jigs, apparatus for cyanide tests and for tests in magnetic concentration. Other rooms are set apart for hand screening, microscopes, balances, a chemical room, and a room for roasting and other high temperature testing of ores in connection with ore dressing. For further research in ore dressing, there are available, Haultain Super-panners and Infrasizers, briquetting apparatus and metal lap machines for the polishing of briquettes in the study of minerals and mill products. The laboratory is also equipped with a Panphot microscope and accessories.

The Crushing laboratory contains a Hadfield gyratory crusher, a set of rolls 16 in. x 12 in., two small Dodge crushers, two sets of miniature rolls, two disc grinders, and a dry screening machine of the Feraris type. Adjoining this room is a large room for practising sampling methods.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

This laboratory is located on the ground floor of the Mechanical Building and comprises an experimental boiler house and a large engine room with special test-bays for internal combustion engines.

The equipment includes: three experimental boilers with stokers and auxiliaries; an injector test-rack with several injectors of different type; impulse steam turbine with hydraulic dynamometer, condensing plant and auxiliaries; reaction type steam turbine with electric dynamometer, condensing plant and auxiliaries; uniflow steam engine; large low speed steam engine with condensing plant; tandem-compound steam engine with condensing plant; two small high speed back pressure steam engines; cross-compound steam driven air compressor; low speed gas engine; medium speed compression-ignition oil engine; hot-bulb ignition two-stroke oil engine; industrial type high speed gasoline engine; two automotive type gasoline engines; automotive type compression-ignition oil engine; two variable compression engines suitable for research and testing of fuels; fuel injection spray characteristics test bench.

Prony brakes, rope brakes, hydraulic dynamometers, engine, indicators, steam calorimeters, air measuring equipment, fuel measuring equipment, exhaust gas analysis apparatus, and instruments such as gauges, thermometers, thermocouples, pyrometers, potentiometers, electric metering equipment, etc., are provided where required.

FUEL TESTING LABORATORY

This laboratory is located on the second floor of the Mechanical Building. Facilities are provided for both undergraduate and research study. The equipment includes precision balances, drying ovens, electric furnaces, a peroxide bomb calorimeter, an oxygen bomb calorimeter, flow calorimeter for gaseous fuels and flow calorimeter for liquid fuels, fuel injection spray characteristics research and test equipment, octane rating testing equipment.

HEAT TRANSFER LABORATORY

The laboratory is arranged on three floor levels in the Mechanical Building, with fluid circulating systems serving all levels through a vertical pipe hatch. Facilities are provided for both undergraduate and research study in the several mechanisms of heat transmission. The equipment includes 24″ and 8″ guarded hot plates and 2″, 3″ and 8″ guarded pipe apparatus for thermal conductivity determinations, together with complete control and measurement recording systems; a multi-purpose constant temperature room, 12′ × 12′ × 9′, providing accurately controlled atmospheres at temperatures from − 30°F. to + 120°F.; Inglis concentric fin-tube, and shell and tube industrial type heat exchangers specially fitted for experimentation, together with controls and auxiliaries; and a gas-fired boiler system supplying steam for rating tests of radiators and convectors.

REFRIGERATION AND AIR CONDITIONING LABORATORY

This laboratory is located on the third floor of the Mechanical Building. Refrigeration equipment includes an ammonia cold storage plant, freon systems for air conditioning, deep freeze unit for temperatures to 120 degrees below zero Fahrenheit, and small demonstration refrigerators of both compression and absorption type. Air conditioning equipment includes fans of centrifugal and axial flow types, steam and water heating coils, water and refrigerant cooling coils, water spray and wet cell type air washers for humidification and dehumidification, and three systems of air ducts for the study of air flow. Also various types of heat exchangers are used with both refrigeration and air conditioning equipment.

HYDRAULIC LABORATORIES

The Hydraulic Laboratories, located in the Mechanical Building are designed and equipped to provide adequate facilities for instruction and research in all phases of fluid mechanics. The laboratories are divided into two main sections—that in which turbines, pumps, pipe flow problems,

fluid measurements, etc., are carried out and a new laboratory in which open channel flow problems and similar allied subjects will be attacked.

(a) The first laboratory is located in the older wing of the Mechanical Building, occupying two floors, each of 40 ft. x 112 ft. area. In this laboratory teaching and research are carried out in several branches of hydraulics. Among the subjects considered are the measurement of the flow of gases and liquids, friction losses in pipes and fittings, the performance of turbines, pumps, compressors and fans, with special studies such as water hammer in pipe lines and cavitation in machines.

The laboratory equipment includes five centrifugal pumps capable of supplying ten cubic feet flow per second to the laboratory supply system, a Belliss and Morcom Steam Engine driving some of these pumps, various weirs, orifices, meters, experimental pumps, a complete turbine, test stand, impulse, Francis and Kaplan turbines, glass-sided channel, measuring tanks, large scales and numerous other equipment.

(b) A new Open Channel Flow Laboratory is located in the new wing of the Mechanical Building. This laboratory occupies the whole basement of the wing and is 200 ft. long by 60 ft. wide. Water is supplied by three axial flow pumps of total capacity 9000 I.G.P.M. Through a rather novel design, all of the supply pipes are carried in trenches below the floor in such a way that water may be delivered to an experiment located in any part of the laboratory and the discharge returned to the sump through troughs also located below the floor level. Constant head conditions are maintained by a head tank having 600 feet of spillway crest. A towing channel 200 feet in length is located along one side of the laboratory equipped with a light car running on steel rails.

This laboratory is designed to permit the carrying out of model tests and all experimental and teaching work on subjects such as open channel flow, wave experiments, erosion studies, hydraulic jump studies, seepage through soils, and similar work.

MECHANICAL LABORATORY

The Mechanical Laboratory, located in the west wing of the Mechanical Building, provides facilities for experimentation in Lubrication, Bearing Friction, Efficiency of Power Drives, Static and Dynamic Stress Analysis, Speed Fluctuation and Governing, Determination of Critical Shaft Speeds, Vibration Measurement and Control, Balancing, and Fine Measurements.

The Gauge Room, air conditioned by a separate system, contains a J. & L. Optical Comparator, Sheffield External and Internal Comparators, a Brush Surface Analyser, Toolmaker's Microscopes, a P. & W. Supermicrometer, a DoAll Inspection Set, Optical Flats, sets of Gauge Blocks, thread and gear measuring equipment, and an array of micrometers, verniers, and other small tools.

The laboratory is provided with standard apparatus for A.S.T.M. tests on lubricants, and special instruments such as vibrometers, tachom-

eters, a strain-gauge bridge, amplifiers, an oscilloscope, a stroboscope, etc. Larger equipment comprises two Olsen Static-Dynamic balancing machines, a Photoelastic Polariscope, a punch press fitted with strain gauges, two single cylinder gasoline engines, and specially designed machines for the testing of belts, worm gear reducers, journal and antifriction bearings, and the calibration of speed measuring instruments.

INDUSTRIAL LABORATORY

The Industrial Laboratory is designed to give students some practical experience in the basic principles of Industrial Management. Problems are worked on a variety of phases of site selection and plant layout, with special emphasis on economic considerations. Experiments are performed to illustrate methods used in industry in such subjects as motion study, including micromotion study, time study, material handling, statistical quality control, training methods and training aids. There are seminar discussions on problems of Industrial Relations. The laboratory is also being equipped for post-graduate and research work.

MACHINE DESIGN LABORATORY

The Machine Design laboratory occupies about 3,600 square feet of floor space on the top floor of the new Mechanical Engineering Building with sufficient specially designed designed desks to accommodate over 100 students at one time. This room has excellent lighting with continuous windows on three sides, two wide north-light skylights, and fluorescent lights.

With convenient freight elevator service practically any type of machine or model can be moved into the Machine Design laboratory for demonstration, instruction, and study.

MACHINE AND WELDING SHOPS

These shops have a floor area of about 2,600 square feet on the ground floor and are serviced by a four ton freight elevator.

The machine shop equipment includes: engine lathes, a turret lathe, milling machines, shapers, drilling machines, grinding machines, saws, and an air compressor (supplying air to all laboratories). The machine tools have been selected to illustrate various types of individual motor drive, and the use of both mechanical and hydraulic table feeds.

The welding shop equipment includes an arc welding machine, and oxy-acetylene welding and cutting torches. The welding shop is partitioned off from the machine shop and is provided with a separate exhaust fan.

These shops have a fourfold purpose. (1) Demonstration of machine tools, machining and welding methods, and time and motion study procedures. (2) Research and post-graduate work in metal cutting and welding. (3) Construction of research and other special equipment. (4) Maintenance work for all laboratories.

CHEMICAL ENGINEERING LABORATORIES

The Wallberg Memorial Building houses the Department of Chemical Engineering. That part of the building occupied by the department has been especially designed and equipped for the instruction of students in chemical engineering.

The general undergraduate chemical laboratories provide facilities for all engineering students taking chemical laboratory work. There are also rooms devoted to special instruction in fundamental chemical principles, many of which also find application in industrial laboratories; for example, polarimetry, the measurement of hydrogen-ion concentration, gas-analysis, calorimetry as applied to fuels, quantitative organic analysis, colorimetry. A full-time glass-blower not only makes the increasingly complex glass apparatus required for chemical work, but also gives students instruction in the elements of glass-blowing as a regular part of their course.

Research laboratories designed for occupancy by one or two students provide excellent facilities for graduates proceeding to the M.A.Sc. and Ph.D. degrees.

The chemical engineering laboratory is a room 56′ x 72′ running through two floors, the upper floor being in the form of grill-work over about half the area with an open well in the centre. This makes it possible to erect equipment of a small-scale industrial type. A travelling crane permits easy handling of heavy pieces of equipment. Off one corner of the laboratory there is an apparatus shaft 8′ x 12′ running through to the roof, with grill-work at each floor. This provides 65′ head-room for experimental work on certain types of operations that are becoming industrially important. The principal items of permanent equipment in the chemical engineering laboratory are a 24-plate experimental still, a triple-effect evaporator, a climbing-film evaporator, two plate and frame filter presses, a rotary filter, two heat exchangers, a vacuum drier, a gas-absorption tower, a crusher, a ball mill, a Werner-Pfleiderer shredder, a sulphonator, autoclaves for hydrogenation, a steam-heated evaporating pan, and general-purpose pumps and tanks. Undergraduates use nearly all this equipment as part of their course, studying, for example, the principles of distillation, gas-absorption, heat transfer, filtration; and carrying out small-scale industrial operations in this typical equipment. For example, they transform benzene into phenol by recognized procedures, and hydrogenate (i.e. "harden") a vegetable oil to a solid fat.

Apart from this general chemical engineering laboratory, which can be used for research purposes as well, there are three chemical engineering research laboratories, which consist of rooms 16′ x 21′ containing only the usual services. These will permit carrying out projects involving the construction of special equipment. There is also a room of about the same size containing 8 reinforced concrete cubicles for carrying out high-pressure work in autoclaves.

A machine shop 31′ x 17′ containing representative equipment provides the necessary machine-shop service to the chemical engineering laboratory in particular and to the department in general.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. Several motor generator sets are available for experiments on synchronous and induction machine. Transformers and alternating-current motors of various types; a model transmission line; a special 25-h., 22-pole, 60-cycle synchronous machine; and necessary instruments and auxiliary apparatus are available.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

ENGINEERING ELECTRONICS LABORATORY

The Engineering Electronics Laboratory, located on the top floor, is equipped for experiments on electronic applications in the industrial power frequency fields. The equipment includes cathode ray oscillographs of twin beam and conventional types, hot cathode rectifiers, pool cathode mercury arc rectifiers, thyratrons, ignitrons, photo-electric cells and the necessary auxiliary equipment such as power supplies, transformers, amplifiers, and measuring instruments. The equipment is so designed that circuits for the study of fundamental principles may be arranged easily and quickly. While typical commercial tubes and components are employed, they are used in such a manner as to give the greatest educational value rather than to illustrate finished commercial products.

METALLURGICAL ENGINEERING LABORATORIES

The completion of the Wallberg building permits the expansion of the Metallurgical Engineering laboratories in the Mining Building. The laboratories now occupy some 14,000 sq. ft., which is distributed between extractive or process metallurgy, physical metallurgy and ceramics.

The extractive metallurgy laboratories are located in rooms S5 and 21 in the basement. The former houses a number of gas furnaces for melting, heat treatment, and reduction processes. The furnaces are equipped with adequate services including ventilation and automatic temperature control. An experimental foundry is to be placed in this room.

The electric furnace laboratory is housed in room 21, and is equipped as follows: A 50 H.P. motor-generator set provides 60 cycle current at various voltages between 27.5 and 550. A 200 K.v.a. transformer provides 25 cycle current at various voltages between 30 and 120. These services supply resistance furnaces of special design and also operate standard electric furnaces of arc and induction type. A 100 K.v.a. direct arc furnace and a 15 K.v.a. Detroit rocking furnace are available. Induction furnaces include 7.5 K.v.a. and 15 Kw spark oscillators (on loan from National Research Council and used for research work).

The laboratories contain outstanding equipment for conducting metallurgical reactions in vacuo or special atmospheres. This equipment is available for the production of reactive metals such as magnesium, titanium, etc.

Hydro-metallurgical equipment includes apparatus for leaching and electrolytic deposition in circulating systems.

The laboratory for metallurgical analysis is well equipped to give students training in mill and smelter methods, the analysis of furnace products, ferrous and non-ferrous alloys, and specialized ceramic bodies.

In the heat treatment and pyrometry laboratory are a number of gas and electric furnaces, type "K" L and N potentiometer, L and N Speedomax recording potentiometer, together with a number of millivolt type temperature controllers. Disappearing filament, optical and radiation pyrometers are available.

The physical metallurgy laboratories will be located on the ground and first floors of the Mining Building. Grinding and polishing rooms include standard polishing wheels and hydraulic press for specimen mounting. The metallography laboratory is equipped with a horizontal Bausch and Lomb photo-micrographic camera, desk metallurgical microscopes, and a B and L Research Metalloscope.

The laboratories also contain a "Tensometer" for making small tests, a Rockwell machine, Tukon micro hardness tester, etc.

The atomic structure of metals can be examined by means of a Phillips X-ray Diffraction Machine, which is fitted with various types of cameras (powder, back-reflection, etc.) for various uses.

The laboratory workshop is fitted with the usual machine tools and also includes welding equipment as follows: D.C. arc, oxy-acetylene, spot welder, and atomic hydrogen welder.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials.

A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for reception.

UNIVERSITY SURVEY CAMP

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, and Mining Geology, as well as for other students taking special work. The country is broken and rolling, and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

The charge for accommodation at the 1950 camp will probably be $1.75 a day.

Mail, telegrams, or telephone messages should be addressed to "University Survey Camp, Minden, Ontario."

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

ELECTROCHEMICAL LABORATORIES

The Electrochemical laboratories, which are situated in the Mining Building, are provided with special facilities for electrolytic work, including a large storage battery and electroplating dynamo with tanks, as well as a set of apparatus and electrical measuring instruments, for both undergraduate work and research. The experimental work on electric furnaces

is carried out in a large furnace room in the basement, occupied jointly by the Department of Metallurgical Engineering and the Department of Chemistry (Electrochemistry). The equipment for this purpose comprises a 120 kw., 220 volt supply of direct current from the main power house through a switchboard, rheostats, circuit-breaker, and instruments to a set of distributing bus-bars, and a 200 k.v.a. transformer stepping down from 2,200 volts to 30-120 volts in 3 and 6 volt steps, which supplies alternating current at 25 cycles. There is a complete set of A.C. instruments, circuit-breakers, oil-switches, relays, automatic regulating winches, etc., and a Northrup high frequency furnace with its transformer is also installed. The two departments co-operate in the use of a Hoskin carbon plate furnace and a resistor tunnel furnace. Facilities for the study of high current carbon arcs and the thermal behaviour of refractories are also provided.

GEOLOGICAL LABORATORIES

The Geological laboratories are equipped for the study of geology from the modern viewpoint. Collections of rocks and minerals, models and natural specimens illustrating various geological features, topographic and geological maps for exercises in map reading, and fossils are all employed in the study of general geology. Typical index fossils are utilized, along with geological maps, in historical geology.

In the Economic Geology laboratory, numerous suites of specimens of ores and rocks illustrate the nature and occurrence of the deposits in many mining camps. A set of building stones, uncut, cut, and polished, is available for a course on that subject. These materials are studied megascopically and microscopically to determine the character and associations of their mineral constituents. The Metamorphic Geology laboratory is supplied with specimens, thin sections, and petrographic microscopes for the study of metamorphic minerals and the changes that rocks undergo in thermal and dynamic metamorphism. Hand specimens and thin sections of suites of rocks from numerous Precambrian areas are also available for work in Precambrian geology. Facilities are available for sawing and polishing specimens of ores, and rocks, and for making thin sections.

For work in structural geology, natural specimens and geological maps exhibiting complex structural conditions and structural problems illustrated by diagrams and drill logs, are extensively employed. For field methods in geology, the laboratories are supplied with geological and topographic maps, survey instruments, and various other equipment, so that work in the laboratory may supplement that in the field.

MINERALOGICAL LABORATORIES

The Mineralogical laboratories in the Mining Building provide facilities for most types of investigation involving minerals, crystals, and rocks.

Courses in laboratory work in the personal examination of type sets of named minerals, crystals, and rocks serve to illustrate the introductory lectures. More advanced work is provided in the identification of unknown minerals by physical tests, blowpipe, and other methods.

To encourage the study of pure crystallography, the laboratories are supplied with goniometers of the various types, crystal models, appliances for the cutting of oriented crystal sections and for their physical examination. Practical petrography is carried on in rooms provided with type sets of rocks, both macroscopic and microscopic. Advanced students are taught to make thin sections of rocks and polished sections of opaque minerals, and to study them microscopically.

The laboratory for the preparation of thin sections of rocks and minerals is provided with electric diamond saws and grinding appliances for the various types of work incidental to the preparation of thin sections. It is also equipped for the preparation of polished specimens for the microscopic examination of the opaque ore minerals.

The department is equipped with petrological and mineralographical microscopes, so that it is possible to provide advanced students with instruments and sets of thin sections and polished minerals for their own special use. Sets of index liquids and a universal stage are available for students interested in more advanced methods for determining the optical properties of crystals.

A well equipped X-ray laboratory, with suitable goniometers for the study of crystal structure, is available to qualified advanced students.

ROYAL ONTARIO MUSEUM

Archaeology, Geology and Mineralogy, Palaeontology, Zoology, Division of Museum Education

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum.

The Museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free to the public on Tuesday, Thursday, Saturday, and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of their students in respect of all matters arising or occurring in or upon their respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SECTION XIV—UNIVERSITY HEALTH SERVICE

I. *Membership:* Membership in the University Health Service is obligatory for all students, with the following exceptions:

(a) Women living in residence at Victoria College, for whom the College provides its own Health Service.

(*b*) Students in the Pass Course for Teachers, in courses leading to the degrees of Bachelor of Science in Medicine, Bachelor of Science in Dentistry and Bachelor of Pedagogy; and certain graduate and occasional students.

Those for whom the fee is not compulsory may be granted membership on payment of the fee, provided this is done at the time of registration.

II. *Objective:* The objective is the preservation and promotion of the health of the students.

III. *Facilities:* The Health Service maintains a close liaison with the Medical Service of the Department of Veterans Affairs.

(1) Medical Examination. By order of the Board of Governors, a medical examination by the Health Service is compulsory for:
(a) Undergraduate students in their first year of attendance at the University. This examination is to be completed within one month of registration. Thereafter, the examination is to be repeated following any serious illness or accident.
(b) Any undergraduate student who, at the previous year's examination, was placed in a Category below B, i.e. B(NS), B(NBC), D, and E.
(c) Any student, graduate or undergraduate, whose domicile is not in Canada. This examination is to be completed annually within one month of registration.
(d) Any student, graduate or undergraduate, where the Health Service has reason to believe that such an examination is necessary in the interest of the health of the student or of the public.
(e) Any student, graduate or undergraduate, annually, before participating in organized competitive athletics. The Health Service shall have the right to debar any student on medical grounds from participating in athletics, and also to recall any athlete for examination.
An opportunity will be afforded annually for all students to have a medical check-up if they so desire.

(2) X-Ray Chest Survey for Pulmonary Tuberculosis. By order of the Board of Governors, the following groups of students

must have an x-ray examination of the chest as arranged by the Health Service:

(a) All new students.
(b) All final year students.
(c) The following students annually:
  (i) Medical students.
  (ii) Students of the School of Nursing.
  (iii) Students whose domicile is not in Canada.
(d) Dental students in their first year and last two years.
(e) Any student for whom it is considered necessary.

(3) A Clinic Service. Any student may consult a Staff Physician at the Health Service between the hours of 9 a.m. to 4.30 p.m., Monday to Friday, and 9 a.m. to 12.30 p.m. Saturday, while the University is in session.

It is essential that students should develop a sense of personal responsibility for the preservation and promotion of their own health, and if they are not enjoying good health, they are urged to consult a physician at this clinic.

(4) Athletic Injury Service. The University does not accept any responsibility for injuries sustained by students while engaged in physical education classes or in University athletic activities, but through the Student Health Service, provides for treatment within the following limits Minor conditions are treated at its offices and at Hart House Surgery during certain hours. In the case of more serious injuries requiring specialist or hospital care, it will provide further treatment within the limits set out hereafter, provided such treatment is taken under the direction and care of staff retained by the Health Service. Treatment is limited to students who have paid the Health Service fee, and who suffer accidents while engaged in, and which arise out of University physical education classes and competitive athletics or physical recreational activities, other than skiing, sponsored by the University of Toronto Athletic Association, the Women's Athletic Association, and by the Hart House Squash Club. Members of the University and Interfaculty Ski Squads, if registered as such with the University of Toronto Athletic Association, are covered while skiing as members of such Squads.

In order to qualify for these benefits, it is necessary to notify the Health Service of injuries within twenty-one days of their occurrence. It shall be the student's responsibility to provide proof of his eligibility for this treatment.

Benefits. If such injuries shall necessitate within 90 days from the date of accident, any of the following benefits, the Health Service will provide:

(*a*) Hospital and Infirmary Benefits. The actual cost of confinement to a licensed hospital or a University Infirmary, but not exceeding $7.00 per day in the case of hospital and $5.00 per day in the case of Infirmary; and for a total period not exceeding ninety days in respect of any one accident to any one student.

(b) Certified Specialist Fees. The proper fees of legally qualified and certified specialists in any branch of medicine or surgery, but not exceeding the fees provided for such services in the Ontario Medical Association Schedule of Fees; and in no event exceeding $200 if such injured student is hospitalised for twenty-four or more hours, or $100 for all other cases.

(c) Miscellaneous Expenses. The amount expended but not exceeding $100 in any one case for the services of an anaesthetist, the use of an operating room, x-rays, surgical dressings or medicine, if such services and supplies shall be provided in a licensed hospital. Ambulance charges are included in the above.

(d) Dental Fees. The cost of dental x-rays and dental fees not exceeding $100 for the treatment of injury to sound, natural teeth.

(e) Other Insurance. Where a student is eligible for similar benefits under any other prepaid plan, the University Health Service shall be responsible only for that amount in excess of those other benefits and up to the limits above stated.

Exclusions. The benefits provided by the Athletic Injury Service shall not cover injuries sustained in transit to or from the specified activities. Nor shall it cover hernia or bacterial infections (except pyogenic infections which shall occur through an accidental cut or wound) or any other kind of disease. Nor shall it cover any injury caused directly or indirectly, wholly or partly, by willful misconduct or rowdyism, or by bodily or mental infirmity. Nor shall it cover any costs the result of accident causing miscarriage, abortion, or aggravation of pregnancy.

(5) Health Education. The Health Service provides health education through individual consultations and at times by lectures on subjects related to the preservation and promotion of health.

For students living away from home who have not a private physician, the following services will, when available, be provided for a nominal additional charge. In the case of students on rehabilitation grants, these charges will be borne by the Department of Veterans Affairs.

(6) A Visiting Service. An initial visit only will be paid for advice and disposal. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) is made for this visit and is payable to the Chief Accountant.

(7) An Infirmary Service. This service is for the treatment of minor illnesses only, and is available from October 1st to May 15th, and during the actual session only. A charge of $3.00 per day, payable to the Chief Accountant, is made to cover cost of meals, nursing and routine medications.

V. *Appointments.*

(a) *Medical Examinations.* These examinations commence immediately after Labour Day in September. The examinations are by appointment only, which may be made either by telephone or in person at the Health Service offices.

The importance of keeping and being on time for the appointment as made, cannot be over-emphasized. Undergraduate students in their initial year of attendance at the University, students whose domicile is not in Canada, and all students, graduate or undergraduate, proposing to engage in athletic activities, will be examined first. The remaining years will be offered an opportunity for this examination in succession. Examinations must be completed before March 15th.

(b) *X-Ray Examination of Chest.* The Tuberculosis Survey takes place early in the Autumn Term. Arts Men students, and all women students, make their appointments in person at their respective Health Service offices. Appointments for Men students in faculties other than Arts are made through their Class President.

The *Varsity* should be carefully watched for notices relative to all appointments.

V. *Communicable Diseases.* Any student who has suffered from one of the communicable diseases must report to the Health Service prior to returning to the University.

VI. *Students Whose Domicile is not in Canada.* All such students are required to submit with their formal application, a certificate by a qualified medical practioner stating that:

(1) the student is in good health and free from contagious or infectious disease, and fit to pursue his proposed course of study at this University.

(2) In addition, an x-ray film of the chest has been made within one month of the certification, and shows no evidence of tuberculosis.

They are further warned that their registration is conditional on their passing the required health examination by the University Health Service, which includes an x-ray of the chest and which must be completed within one month of registration.

VII. *Fee:* The Health Service Fee is included in the "University Incidental Fees" and is paid at the time of registration.

VIII. *Directory:*

	Address	*Telephone*
Health Service (Men)	43 St. George St.	MIdway 9644
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		
Health Service (Women)	43 St. George St.	MIdway 2646
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		

N.B. This office is closed during vacation periods. At these times, general information may be obtained from Health Service (Men), and those eligible for service may make an appointment to see Dr. Frances Stewart or her substitute at her private office, by telephoning KIngsdale 7537.

Hart House Surgery	Hart House	MIdway 5838
Hours Open: Monday to Friday, 5 to 6.30 p.m. (during actual session only)		local 201
Infirmary (Men)	42 St. George St.	MIdway 3017
Open October 1st to May 15th and during the actual session only.		
Infirmary (Women)	Women's Union 79 St. George St.	KIngsdale 8163

Open October 1st to May 15th and during the actual session only. Accidents which occur after 6:30 p.m. (or 1 p.m. on Saturday), or which are of a sufficiently serious nature as to require immediate hospital attendance, should be taken:

Men: To the Emergency Department, Toronto General Hospital, College St.

Women: To the Emergency Department, Women's College Hospital, 76 Grenville St.

To obtain a physician after hours call KIngsdale 8163, if no answer, call KIngsdale 4141, and ask for the University Health Service physician.

REQUIRED PHYSICAL EDUCATION—MEN

By order of the Board of Governors each man proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first and second years of his attendance at the University. The physical education requirements include a swimming test which must be taken before November 1st by all first year men and by men admitted to the second year from other Universities. Swimming classes are compulsory for all students who fail to pass the swimming test. All men required to take Physical Education must register at the Key Office in Hart House before October 15th.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year. The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the second year will not be permitted to register in the fourth year. Furthermore, the student who has failed to complete satisfactorily all requirements in Physical Education will not be allowed to receive the Bachelor's Degree.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

REQUIRED PHYSICAL EDUCATION—WOMEN

By order of the Board of Governors each woman proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first year of her attendance at the University. The physical education requirements include a swimming test which must be taken before October 21st by all First Year Women. Swimming classes are compulsory for all students who fail to pass the required swimming test. This test must be taken by October 22nd. All women required to take Physical Education must register at the Physical Education office, 153 Bloor Street West, before October 2nd.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first year must take this work during the second year of her attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, a tuck-shop where light refreshments are served, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, photographic rooms, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily. Meals are served to students in the Great Hall from Monday to Saturday lunch. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, and the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of five of these (House, Library, Music, Art, and Debates) together with certain appointed representatives, sit on the Board of Stewards, the governing board of the House, which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Graduate Secretary's office for election by the Membership Committee.

Graduate students, graduates of this university resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is under the direct administration of the University of Toronto.

Control of the Theatre is vested in a Board of Syndics appointed by the Board of Governors. The purpose of the Theatre is the encouragement of Dramatic Art in all its aspects, particularly among the undergraduates of the University. The Theatre has a resident director and competent staff who are available for consultation and assistance. Their main activity is the production of a series of plays with all-student casts.

The Theatre was founded by the generosity of the trustees of the Massey Foundation, particularly the Right Honourable Vincent Massey and Mrs. Massey. Under the Massey Foundation and with the assistance of outstanding directors the Theatre has established an enviable reputation in Little Theatre activity throughout North America.

THE SOLDIER'S TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Great War (1914-1918), the graduates have erected the Soldiers' Tower. Situated at the southwest corner of Hart House, the Tower rises—a symbol of sacrifice—and with its screen forms a majestic link between Hart House and the old Main Building. Beneath the sheltering arches of the screen, the names of the six hundred and eighteen, to whom the memorial pays its proud and affectionate tribute, are cut deep in the stone. Above, in the belfry of the Tower, a carillon that, as it chimes, weaves a fabric of memories for professors and students who take up the tasks laid down by those who fell.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the University. The Students' Administrative Council publishes *The Varsity*, *Torontonensis* and the *Students' Handbook*. It represents the students at University functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Applications for loans must be made to the General Secretary-Treasurer of the Students' Administrative Council. The maximum loan is $100.00. A short-term emergency loan fund is available to ex-service personnel pending receipt of maintenance grants or war service gratuities.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The University Symphony Orchestra, University Mixed Chorus and University of Toronto Band are activities of the Council in which undergraduates of the University may participate. The Council through its Radio Committee conducts courses in announcing, script writing and casting which are for undergraduates. These are under the direction of competent instructors from the C.B.C.

Through its organizations such as the Blue and White Society and the All Varsity Revue, the Council endeavours to promote a University consciousness and loyalty amongst the undergraduate body.

The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund for students in the first two years of their courses. The fee also covers the administration costs of the Students' Administrative Council.

The Students' Administrative Council is prepared to make to ex-service personnel emergency loans pending receipt of their entitlements under the Educational Benefits provided in the Post-discharge Re-establishment Order.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

the President of the University,
two members of the faculty, appointed by the President,
two graduates, appointed by the Athletic Advisory Board.
the Director of University Health Service, the Director of Athletics and the Financial Secretary (*ex-officio*),
five undergraduates, elected annually, from the student body,
an undergraduate representative, appointed by the Men Students' Administrative Council.

Under the authority of the Board of Governors the Athletic Directorate shall have full control of the administration of the funds of the Association, which are used in furthering the development of competitive and recreational athletics for University students.

The Directorate subject to the approval of the President is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Education available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

the President of the University,
two women members of the faculty, appointed by the President,
the Assistant Director of University Health Service in charge of Women, the Director of Physical Education for Women, and the Financial Secretary (*ex-officio*),
six women undergraduates, elected annually,
one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate also controls and administers the voluntary programme in Athletics and Physical Education available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Under the authority of the Board of Governors, the Women's Athletic Directorate administers the funds of the Association which are used to further the development of competitive and recreational athletics for undergraduate women.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.
(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.

(*f*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.
(*g*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.
(*h*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.
(*i*) The Debating Club of the Engineering Society, composed of the undergraduates in all courses.

These clubs devote themselves to subjects of special interest to their members. Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, confer-

ences, lectures, work projects, and social services in the down-town district. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the S.C.M. offices in Hart House and the Household Science Building.

ENGINEERING CHRISTIAN FELLOWSHIP

The Engineering Christian Fellowship is a group of engineering students from each branch of engineering that meet regularly to increase their knowledge and experience of the Christian Faith. They also seek to present the challenge of Christ's claims to their fellow students and to make these claims relevant to them as engineers.

The ECF is one of six such Varsity campus groups, all members of the Inter-Varsity Christian Fellowship which in its turn is part of a world-movement among students. The Engineering Christian Fellowship has been active for a number of years now and maintains a programme of daily devotions, Bible discussions, and special weekly features. Occasionally, it joins the other Fellowship groups on the campus for special series of addresses, worship services, or weekend conferences.

The Engineering Christian Fellowship seeks to encourage a whole-hearted allegiance to Jesus Christ as Lord and Saviour. However, it welcomes into its Fellowship those of all views and backgrounds and seeks to demonstrate its Christian convictions in an atmosphere of friendship. Further information as to its activity is published regularly in *The Varsity* or may be secured by phoning the Inter-Varsity Christian Fellowship office at KIngsdale 4188.

UNIVERSITY OF TORONTO
UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division course has been instituted by the Royal Canadian Navy to provide an opportunity for suitable young men in Canadian universities to perform officer's training while they are undergraduates and prepare themselves thereby for promotion to commissioned rank in the R.C.N. or R.C.N.(R) on graduation.

Men who are accepted are entered at first in the lowest rating of the branch for which they apply. If they pass a selection board which takes place before 1st February of their first academic year, they are advanced to the rank of Cadet R.C.N.(R). On graduation a successful cadet may be promoted to either Acting Sub-Lieutenant, R.C.N., or Sub-Lieutenant, R.C.N.(R).

(a) Students in Electrical Engineering, Engineering Physics, Mathematics and Business are entered as Ordinary Seamen Electricians' Mate Standard, UNTD.

(b) Students in Engineering other than courses listed in (a) are entered as Ordinary Seamen Stoker Mechanics Standard, UNTD.

(c) Students in Medicine are entered as Medical Assistants Standard UNTD.

(d) Students in Arts, Commerce, Law, or Business Administration who elect to enter the Supply and Secretariat Branch are entered as Ordinary Seamen Writers Standard UNTD.

(e) (i) Students in any course not mentioned in (a), (b), or (c),

or

(ii) Students in Engineering, but who have not decided at the time of entry upon their particular Engineering courses;

(iii) Students listed in (d) who do not select the Supply and Secretariat Branch are entered as Ordinary Seamen UNTD.

(f) Pre-medical students are entered as Ordinary Seamen UNTD.

UNTD men are given a minimum of sixty hours' training during the academic year. They must do two full summer vacation periods of training at the coast and a minimum of two weeks' training during other summers. Summer training consists of cruises at sea and courses in schools ashore.

Until promoted to the rank of Cadet R.C.N.(R), U.N.T.D. men wear uniforms similar to those of seamen in the Royal Canadian Navy, thereafter they wear special cadet uniforms.

UNTD members are paid training allowance for attendance at Divisional Drills performed during the academic year. The total training allowance paid during an academic year for a man or cadet shall not exceed sixteen days' pay at $58 per month for the first year men, for Cadets R.C.N.(R) $153 per month. During summer training periods the monthly rates of pay for U.N.T.D. members are as follows:

	Naval Training	Voluntary Service
First year U.N.T.D. course (men)	$ 68	$ 79
Second year U.N.T.D. course (men)	79	88
All cadets R.C.N.(R)	153	153

Students in the U.N.T.D., University of Toronto, are part complement of H.M.C.S. "York", and their administration, training, and discipline are under the jurisdiction of the Commanding Officer, H.M.C.S. "York".

Area Commanding Officer..............Captain F. R. Base, R.C.N.(R)
Commanding Officer....Lieutenant-Commander R. F. McRae, R.C.N.(R)
Executive Officer......Lieutenant-Commander A. W. Brown, R.C.N.(R)
Staff Officer..................Lieutenant E. M. Gruetzner, R.C.N.(R)

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

In view of the record of the officers who received their training in the COTC before and during the war, the Director of Military Training at Canadian Army Headquarters has stated that this Corps, together with the Royal Military College and Royal Roads, is now looked upon as the chief source of officers for the Canadian Army.

A student who completes his training in the COTC is granted a commission as a lieutenant in the Canadian Army upon graduation and may join the Active Force (permanent army), if vacancies are available, or the Reserve Force. He is, however, under no obligation to do so but may remain on the Supplementary Reserve (inactive list).

Training is organized into two portions:

(a) Practical training, twelve to sixteen weeks each summer at Active Force Schools.

(b) Theoretical training, lecture courses during two academic sessions; not more than forty lectures per year.

Pay during the summer is $153 per month, and for those completing each theoretical lecture course, an additional ten days' pay. During summer training, board, lodging, clothing and transportation from home or University to Corps Schools and return, are all provided free of charge.

To be eligible, students must be seventeen years of age, British subjects physically fit, and following a course of study leading to a University degree.

Arrangements have been made so that summer training may be accepted in part for the summer practical work required in certain faculties and courses.

Application for training should be made in person before the 15th of November to Contingent Headquarters, 119 St. George Street, Toronto. Previous experience has been that more applications are received than can be accepted. Early application is advisable.

The Contingent Staff for the session 1950-1951 is:

Honorary Colonel....................Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer................Lieutenant-Colonel W. L. Sagar
Second-in-Command................Major L. S. Lauchland, E.D.
Adjutant..........................Captain H. A. Webster
Resident Staff Officer...............Major G. MacLean Logan, p.s.c.
Assistant Resident Staff Officer.......Captain F. J. Murphy

ROYAL CANADIAN AIR FORCE (RESERVE) UNIVERSITY OF TORONTO FLIGHT

In 1948-1949 a University Flight of the RCAF was established at the University of Toronto. Initially this Flight was organized as a university

detachment of 400 Squadron—a Toronto-based fighter squadron of the RCAF (Reserve); but in 1949-1950 it became established as a separate Reserve Training Unit on strength of RCAF Station, Toronto.

The function of the University Flight is to foster interest in the RCAF and furnish a flow of trained university students into the Regular and Reserve Air Force as commissioned officers. Its establishment provides placement for approximately 150 undergraduates, largely but not exclusively drawn from courses in pure or applied science or medicine.

It is expected that at the commencement of the academic session 1950-1951 there will be approximately 50 vacancies in the University Flight, these being reserved entirely or largely for men of classes due to graduate in 1954. Students selected for these vacancies are appointed to the rank of Flight Cadet—a comparatively new officer rank, which may be thought of as that of an officer cadet. Before appointment as Flight Cadets, students are required to sign an undertaking that upon completion of their service in the Flight they will, for a period of five years, remain in the RCAF (Reserve) or transfer to the RCAF (Supplementary Reserve), or will accept appointment to the RCAF (Regular) if they desire and are selected for such appointment.

While serving as members of the University Flight, students are given "winter training" consisting largely of lectures during, normally, three successive academic years. Their three sessions of winter training are each immediately followed by a period of "summer training". In the case of Flight Cadets selected for aircrew, this training consists of spending three summers in qualifying to "Wings" standard as navigators, pilots or radio officers. In the case of Flight Cadets selected for other training, this consists of training and employment at appropriate schools or other units of the RCAF during summer months of three successive years. For winter training, the pay allowed each University Flight Cadet is approximately $25.00 in his first year, and $50.00 in each of his second and third years. For summer training his entitlement, ordinarily for a period of from four to five months, is $153.00 per month plus rations and quarters valued at $55.00 per month. These rates of remuneration are supplemented by certain extra allowances for those Flight Cadets who participate in winter or summer flying training.

The RCAF Orderly Room at the University of Toronto is located at 119 St.George Street, and serves as a focal point not only for affairs of the University Flight but also for other interests of students in the RCAF. In this Orderly Room, undergraduate veterans of the RCAF, RAF, or other Commonwealth Air Forces who desire to participate in the Veterans' Summer Employment Plan of the RCAF may file applications; and members of graduating classes (and other interested students) may obtain information regarding full-time service in the RCAF (Regular), and file applications for appointment to such service.

In the session 1949-1950 the staff of the RCAF on the campus of the University of Toronto was as follows:

University Air Liaison Officers.................W/C T. R. Loudon, VD
S/L F. L. Hutchison
RCAF Resident Staff Officer...................F/L M. A. Everard
Clerk.....................................Sgt. P. G. Mickus
Officer Commanding RCAF (Reserve)
University of Toronto Flight................S/L F. L. Hutchison
Second-in-Command.........................F/L R. H. Perry

UNIVERSITY ADVISORY BUREAU

The University Advisory Bureau seeks to make its own contribution to the life of the University by providing within the University a neutral zone where the student may discuss in freedom and in confidence personal matters of the most fundamental importance to his successful development as a student, as a worker, as a citizen and as a fully effective person.

In keeping with this objective, the Bureau performs the following functions:—

(a) Through liaison with the University departments, the Registrars' offices and appropriate services on the campus, the Bureau furnishes information and assistance in the financial, educational and personal spheres. The Bureau, for instance, serves as a focal centre for applications to The Veteran-Students' Loan Fund and provides information on other loan facilities, including Navy, Army and Air Force Benevolent Trust Funds. Working with appropriate Registrars' offices, the Bureau helps the student to clarify details regarding entrance requirements, courses of study and related occupational goals. The Bureau is also available for consultation on personal questions involving adjustment to University life, assessment of interests, vocational direction and other matters of a similar nature; where advisable, students are referred to more specialized services.

(b) Liaison with D.V.A. The Bureau works closely with the Department of Veterans Affairs, both locally and with Ottawa headquarters, on all matters affecting the interests of ex-service students and in many ways serves as a campus clearing house for problems which might otherwise require to be referred to the Toronto office of D.V.A.

(c) Liaison with other universities. In contact with the Advisory Bureaus located at other Universities across Canada, the Bureau seeks to maintain up-to-date information on local variations in all fields significant to ex-service students—entrance requirements and application deadlines, courses available, length of training, degrees awarded, etc.

The personnel consultants associated with the Bureau have for the most part seen service in the late war and have been associated with the Personnel or Rehabilitation Directorates of the Navy, Army or Air Force.

The Bureau is located at 67 St. George Street.

SECTION XVII. LODGING AND BOARD

Housing Service for Students

For students who are not accommodated in the University and College residences, the Students' Administration Council prepares annually a list of inspected and approved rooming houses, flats, partments and homes. This list may be consulted at the Housing office in Hart House after August 1st and throughout the session.

To meet the housing shortage in Toronto, the Students' Administrative Council has greatly expanded its Housing Service. Every effort is being made to provide accommodation for married ex-service students and for those who have children. Information may be obtained from the Students' Administrative Council's Housing Service office, Hart House.

Through this service many opportunities have been afforded students, including those students who are married to obtain lodging and board in exchange for part-time services. Students desiring this type of accommodation are asked to indicate this when they apply.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately two hundred men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. As early as possible the summer preceding attendance at the University, each successful applicant will be notified of his assignment. He must then send to the Secretary of the Residence Committee a deposit of $5.00. On receipt of this he will be sent an assignment card. Cheques or money orders must be made payable to the University of Toronto. The deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

The residence dues for the session (exclusive of the Christmas Vacation) are $133.00 payable to the Chief Accountant as follows: $60.00 on or before the opening date of the session; $50.00 by November 20th; $23.00 by February 20th.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1949-50

	Course											
Year	1	2	3	5	6	7	8	8a	9	10	11	Total
I	68	7	72	28	97	79	5	3	18	12	51	440
II	113	12	116	38	85	83	20	5	11	10	55	548
III	139	23	205	45	108	158	18	10	22	36	74	838
IV	152	32	249	75	158	194	38	8	30	53	85	1074
	472	74	642	186	448	514	81	26	81	111	265	2900
West Indies Surveyors												5
Total												2905

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such Council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Alumni Association Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wide sphere of University graduate activities through its membership in the Alumni Association of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Alumni Association co-ordinates the activity of all the Associations and edits and publishes the *Alumni Bulletin*, which contains news items and articles of interest to all graduates. Through class Engineering Alumni Association and Alumni Association of the University the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Association of the University; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *Alumni Bulletin* and the *Toike Oike* which is published every now and then. This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Association towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *Alumni Bulletin*.

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 139. Many part-time demonstratorships are open which permit graduate work towards a degree and research assistants are also appointed annually on salary in the School of Engineering Research. This work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE

The regulations governing the Degree of Master of Applied Science (M.A.Sc.) shall be determined as follows:

1a. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

1b. Graduate students are required to perform at least one full session's work (seven months), or its equivalent, before being recommended for the degree of M.A.Sc.

1c. A candidate for the degree of M.A.Sc. must have a good academic record in his undergraduate course and must have an average mark on written examinations of at least 65 per cent in his final undergraduate year, save in exceptional circumstances.

1d. Candidates for the degree of M.A.Sc. are required to pass written or oral examinations in not less than two and not more than five subjects, in addition to the preparation of a thesis, in fulfilment of the requirements for the degree.

2. A candidate wishing to proceed to a graduate degree shall (a) register with the Secretary of the School of Graduate Studies at the beginning of

the academic year, (b) enrol in one of the departments mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him. No applications for the degree of M.A.Sc. will be accepted where it is proposed that the research work be conducted outside the university laboratories.

3. Not later than 31st October of the academic session in which the candidate expects to obtain the degree, he shall submit to the Secretary for acceptance by the Council of the School of Graduate Studies, the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1951, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical and Ceramic Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1951, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degree of Master of Applied Science.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Electrical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1950-51 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examination in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original thesis on an engineering subject in the branch in which he has applied for a degree. The thesis shall be on work in which the candidate has had professional experience.

The thesis shall preferably be in the form of an engineer's report on the design of engineering works, or on processes of manufacture and shall indicate wherever appropriate the economic considerations for the plan adopted. Candidates for the Degree of Chemical Engineer and the Degree

of Metallurgical Engineer may, if permission to prepare a thesis on actual works or processes is not obtainable, submit a thesis on general subjects, provided that the contents are applicable to the particular branch of engineering and are comprehensive of that branch to be of value in that field.

The thesis shall be of professional grade such as would be prepared by an engineer engaged in a professional capacity to report on a project, submit a design, or propose a process. The quality of the thesis will be judged by the Board of Examiners as an indication of the candidate's professional attainments.

A thesis of a solely descriptive type wil not be acceptable.

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the month of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

High School Assistants' Certificates, Type A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 66% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS AND DOMINION LAND SURVEYORS

Examinations are held, usually in February of each year, for the following:

Preliminary Dominion Land Surveyors
Leveller's Examination
Final Dominion Land Surveyors
Ontario Land Surveyors

Any student of the Faculty of Applied Science and Engineering is eligible for these examinations, but graduates in Civil and Mining Engineering are allowed a shortened apprenticeship before writing their final examinations. Full information respecting above examinations may be obtained from the staff in Surveying and Geodesy.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	19
Mechanical Engineering	28
Engineering Physics	12
Chemical Engineering	13
Electrical Engineering	30
Metallurgical Engineering	17
Mining Geology	30
Aeronautical Engineering	20
Total	169

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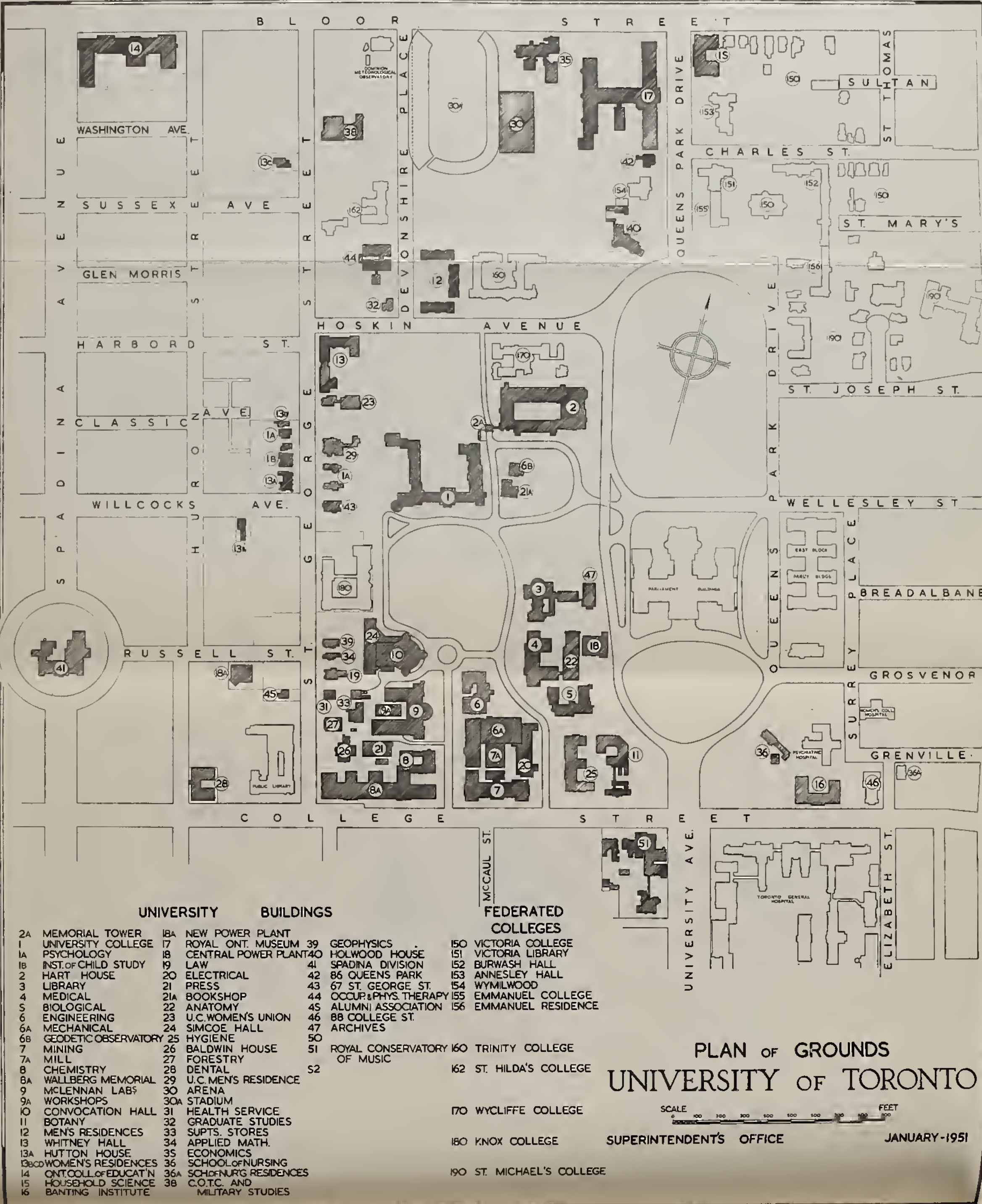
BLOOR STREET
SPADINA AVENUE
WASHINGTON AVE.
SUSSEX AVE
GLEN MORRIS
HARBORD ST.
CLASSIC AVE.
WILLCOCKS AVE.
HURON STREET
RUSSELL ST.
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
CHARLES ST.
SULTAN
ST. THOMAS
ST. MARY'S
ST. JOSEPH ST.
WELLESLEY ST
BREADALBANE
GROSVENOR
SURREY PLACE
GRENVILLE
COLLEGE STREET
McCAUL ST.
UNIVERSITY AVE.
ELIZABETH ST.
BAY STREET
DOMINION METEOROLOGICAL OBSERVATORY
PUBLIC LIBRARY
PARLIAMENT BUILDINGS
EAST BLOCK
PARRY BLDG.
TORONTO GENERAL HOSPITAL
PSYCHIATRIC HOSPITAL
WOMEN'S COLL. HOSPITAL
UNIVERSITY BUILDINGS
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1 UNIVERSITY COLLEGE
1A PSYCHOLOGY
1B INST. OF CHILD STUDY
2 HART HOUSE
3 LIBRARY
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5 BIOLOGICAL
6 ENGINEERING
6A MECHANICAL
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11 BOTANY
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13A HUTTON HOUSE
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14 ONT. COLL. OF EDUCAT'N
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SUPERINTENDENT'S OFFICE
JANUARY-1951

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science
and Engineering
1951-1952

THE UNIVERSITY OF TORONTO PRESS
1951

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SECTION I. CALENDAR 1951-1952

FALL TERM, 1951

July 2	*Monday*	Dominion Day. Buildings closed.
July 14	*Saturday*	Last day for receiving application for supplemental examinations.
August 6	*Monday*	Civic Holiday. Buildings closed.
August 20	*Monday*	Students of the III Year, Courses 1, 2 and 9 report at Survey Camp (Course 1 (part) at Dorset, Courses 1 (part), 2 and 9 at Gull Lake).
August 27	*Monday*	Supplemental Examinations commence.
September 1	*Saturday*	Last day for receiving applications for admission to the I Year.
September 3	*Monday*	Labour Day. Buildings closed.
September 12	*Wednesday*	Special meeting of Faculty Council.
September 20-22	*Thursday-Saturday*	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m. (Saturday 9.30 a.m. to 12.00 noon) at 119 St. George Street.
September 24	*Monday*	Registration in person of the II and III Years from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building.
September 25	*Tuesday*	Registration in person of the IV Year from 9.00 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m., at the Mining Building. Dean's address to the I Year. Preliminary instruction to the I Year. Meeting of Faculty Council.
September 26	*Wednesday*	Lectures and laboratory work commence at 9.00 a.m. The opening address by the President to the students of all Faculties at 3.45 p.m., in Convocation Hall.
October 3	*Wednesday*	Meeting of Faculty Council.
*October 8	*Monday*	Thanksgiving Day. Buildings closed.
October 12	*Friday*	Meeting of Senate.
November 1	*Thursday*	Meeting of Faculty Council.
November 9	*Friday*	General Meeting of Engineering Society. Meeting of Senate.

*Or such other date as may be determined by Order-in-Council.

November 10	*Saturday*	Remembrance Day Service at 10.45 a.m. Lectures and laboratory classes withdrawn from 10.00 a.m. to 11.15 a.m.
December 3	*Monday*	Meeting of Faculty Council.
December 5	*Wednesday*	General Meeting of Engineering Society.
December 14	*Friday*	Meeting of Senate.
December 21	*Friday*	Term ends at 5.00 p.m.
December 25	*Tuesday*	Christmas Day. Buildings closed.
December 26	*Wednesday*	Boxing Day. Buildings closed.

SPRING TERM, 1952

January 1	*Tuesday*	New Year's Day. Buildings closed.
January 7	*Monday*	Spring Term begins. Mid-session Examinations commence.
January 11	*Friday*	Meeting of Senate.
January 14	*Monday*	Meeting of Faculty Council.
January 15	*Tuesday*	Last day for receiving the second term instalment of fees.
February 1	*Friday*	Meeting of Faculty Council.
February 7	*Thursday*	General meeting of Engineering Society.
February 8	*Friday*	Meeting of Senate.
February 22	*Friday*	Engineering Society Annual Elections.
March 4	*Tuesday*	Meeting of Faculty Council. General meeting of Engineering Society.
March 14	*Friday*	Meeting of Senate.
March 29	*Saturday*	Term ends at 12.00 noon.
April 2	*Wednesday*	Meeting of Faculty Council.
April 7	*Monday*	Annual Examinations commence.
April 10	*Thursday*	Meeting of Senate.
April 11	*Friday*	Good Friday. Buildings closed.
May 1	*Thursday*	Meeting of Faculty Council.
May 9	*Friday*	Meeting of Senate.
May 24	*Saturday*	Victoria Day. Buildings closed.
June 2	*Monday*	Meeting of Senate.
June 4, 5, 6	*Wednesday* *Thursday* *Friday*	University Commencement

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . Sidney Smith, K.C., M.A., LL.B., LL.D., D.C.L., F.R.S.C.

Registrar . . . . J. C. Evans, B.A.

Librarian . . . . W. S. Wallace, M.A., LL.D., F.R.S.C.

Warden of Hart House . . . . N. Ignatieff, M.B.E., B.SC.

Director of University Extension . . W. J. Dunlop, B.A., B.PAED., LL.D.

Assistant to the President . . . . C. T. Bissell, M.A., PH.D.

Comptroller . . . . R. E. Spence, B.A., A.C.A.

Bursar and Secretary to the Board of Governors C. E. Higginbottom, F.C.I.S.

Superintendent of Buildings and Grounds . . . A. D. LePan, B.A.SC.

Chief Accountant . . . . G. L. Court, D.F.C., B.COM., C.A.

Director of University Health Service
G. E. Wodehouse, M.C., M.D., F.R.C.P.

Assistant Director of University Health Service—Women
Miss F. H. Stewart, B.A., M.D.

Director of Athletics and Physical Education—Men . W. A. Stevens, B.S.

Director of Athletics and Physical Education—Women Miss Z. Slack, B.A.

General Manager of the University of Toronto Press
A. G. Rankin, B.COM., C.A.

Editor of the University of Toronto Press G. W. Brown, M.A., PH.D., F.R.S.C.

General Secretary-Treasurer of the Students' Administrative Council
E. A. Macdonald, B.A.

Associate Secretary of the Students' Administrative Council
Miss A. E. M. Parkes, B.A.

Director of Hart House Theatre . . . . R. S. Gill, M.A.

Director of the Placement Service . . . J. K. Bradford, O.B.E., B.A.SC.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . . . K. F. Tupper, O.B.E., B.A.SC., S.M. (MICH)

Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.

SECTION III. TEACHING STAFF

1950-51

DEAN EMERITUS

C. R. Young, B.A.Sc., C.E., D.Eng., D.Ès.Sc.A., Hon. M.E.I.C., M.Am.Soc.CE. 72 Roxborough Dr.
Dean Emeritus, Faculty of Applied Science and Engineering

PROFESSORES EMERITI

G.R. Anderson, M.A., A.M. (Harv.), F.A.S.A., M.I.E.S. 5 du Maurier Blvd.
Professor Emeritus of Engineering Physics and Photography

R. W. Angus, B.A.Sc., M.E., Hon. M.E.I.C., Hon. Mem. A.S.M.E.
Professor Emeritus of Mechanical Engineering Mechanical Bldg.

J. W. Bain, B.A.Sc., LL.D., F.R.S.C. 30 Burton Rd.
Professor Emeritus of Chemical Engineering

J. R. Cockburn, M.C., V.D., B.A.Sc., M.E.I.C. 100 Walmer Rd.
Professor Emeritus of Engineering Drawing

G. A. Guess, M.A. (Qu.) Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. Haultain, C.E. National Club
Professor Emeritus of Mining Engineering

C. G. Williams, B.A.Sc. 417 Rosemary Road
Professor Emeritus of Mining Engineering

DEPARTMENT OF AERONAUTICAL ENGINEERING

T. R. Loudon, V.D., B.A.Sc., M.E.I.C., M.I.Ae.Sc. 189 Sheldrake Blvd.
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Special Lecturer in Aeronautical Engineering Islington

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Special Lecturer in Asronautical Engineering Weston

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Instructor in Aeronautical Engineering Thistletown

N. B. Tucker, B.A.Sc. — 181 Chaplin Cresc.
Instructor in Aeronautical Engineering

N. A. G. Blom, B.A.Sc. — 24 Willcocks St.
Instructor in Aeronautical Engineering

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Assistant Professor of Applied Physics

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Lecturer in Applied Physics

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Lecturer in Applied Physics

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Lecturer in Applied Physics

P. A. Macpherson, B.A.Sc. — 90 Cowan Ave.
Instructor in Applied Physics

J. R. Bird, B.A.Sc., M.A. — 56 Rathnelly Ave.
Instructor in Applied Physics

F. Weinberg, B.A.Sc., M.A. — 692 College St.
Instructor in Applied Physics (part time)

F. M. Hill — 25 Ridout Ave.
Instructor in Applied Physics

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A. C. Hamilton, B.A.Sc. — 330 Durie St.
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D. J. Salt, B.A.Sc. — 124 Albany Ave.
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DEPARTMENT OF CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

R. R. McLaughlin, M.A.Sc., M.A., Ph.D. — 102 Glen Rd.
Professor of Chemical Engineering and Head of the Department

E. A. Smith, M.A.(McM.) — Wallberg Bldg.
Professor of Industrial Chemistry

J. G. Breckenridge, B.A.Sc., Ph.D.(Camb.) 23 Douglas Cresc.
Associate Professor of Chemical Engineering

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Assistant Professor of Chemical Engineering

G. W. Minard, B.Sc.(Armour), M.Sc., Ph.D.(Ohio State)
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Lecturer in Chemical Engineering

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Instructor in Chemical Engineering

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Instructor in Chemical Engineering

Miss L. I. Cowan, B.Sc. (Dal.) 140 Bedford Rd.
Instructor in Chemical Engineering

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Instructor in Chemical Engineering

D. W. H. MacDowell, M.Sc. (Queen's, Belfast) 292 St. George St.
Instructor in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

E. J. Halbert, B.A., B.Paed. — 46 Humbercrest Blvd.
Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

H. R. Jenkins, B.A.Sc. — Apt. 17, 725 Eglinton Ave. W.
Demonstrator in Chemical Engineering

W. S. Karpinski, Dip.Chem.Eng. (Lwow) — 4 Mortimer Ave.
Demonstrator in Chemical Engineering

R. F. Knott, B.A.Sc. — 68 Bastedo Ave.
Demonstrator in Chemical Engineering

D. E. Loudon, B.A.Sc. — 168 Glenmanor Dr.
Demonstrator in Chemical Engineering

C. Y. Lu, B.A.Sc. (Nanking) — 229 Beverley St.
Demonstrator in Chemical Engineering

M. J. Mann, B.Sc. (Man.) — 275 St. George St.
Demonstrator in Chemical Engineering

O. C. Samuel, B.A.Sc. — 71 Kendal Ave.
Demonstrator in Chemical Engineering

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DEPARTMENT OF CIVIL ENGINEERING MUNICIPAL AND STRUCTURAL

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Professor of Civil Engineering and Aeronautics and Head of the Department

C. F. Morrison, B.E. (Sask.), M.Sc. (McG.), M.E.I.C. — 21 Douglas Cres.
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Professor of Electrical Engineering

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Lecturer in Electrical Engineering

H. F. Philp, B.A.Sc. — 21 York St., Ajax
Lecturer in Electrical Engineering

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Instructor in Electrical Engineering

D. Shopsowitz, B.A.Sc. — 149 Pendrith St.
Instructor in Electrical Engineering

P. Yachimec, B.Sc. (Alta.) — 183 College St.
Instructor in Electrical Engineering

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Demonstrator in Electrical Engineering

F. G. Buckles, B.Sc. (Alta.) — 19 Northview Ave.
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Demonstrator in Electrical Engineering

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Demonstrator in Electrical Engineering

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Demonstrator in Electrical Engineering

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J. L. Woodward, B.E. (N.Z.) — 159 Elm Ridge Dr.
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Associate Professor of Engineering Drawing
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Lecturer in Engineering Drawing
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Instructor in Engineering Drawing
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DEPARTMENT OF MECHANICAL ENGINEERING

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Lecturer in Mechanical Engineering

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W. T. Thompson, B.A.Sc. — 4 Chesterhill Rd.
Lecturer in Mechanical Engineering

A. J. Wood, B.Sc. (Lond.) — 349 St. Clair Ave. W.
Special Lecturer in Mechanical Engineering

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Instructor in Mechanical Engineering

M. I. Rand, M.Sc. (Zurich) — 20 Thomas Ave., Etobicoke
Instructor in Mechanical Engineering

J. M. F. Vickers, B.Sc. (Birm.) — 61 Fairholme Ave.
Instructor in Mechanical Engineering

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Demonstrator in Mechanical Engineering

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Demonstrator in Mechanical Engineering

A. D. Cumming, B.A.Sc. — 49 Berwick Ave.
Demonstrator in Mechanical Engineering

J. A. Golinski, M.E. (Warsaw) — 30 Austin Cres.
Demonstrator in Mechanical Engineering

M. W. Hattin, B.A.Sc. — 32 Vermont St.
Demonstrator in Mechanical Engineering

M. J. Kenn, B.Sc. (Lond.) — 1228 Davenport Road
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G. T. Keys, B.A.Sc. — 48 Commonwealth Ave., Scarboro Jct.
Demonstrator in Mechanical Engineering

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P. F. O'Rourke, B.A.Sc. — 335 Beresford Ave.
Demonstrator in Mechanical Engineering

J. R. Petrinec, B.A.Sc. — 15 Braemar Ave.
Demonstrator in Mechanical Engineering (part time)

R. Y. Pogontcheff, B.A.Sc. — 39 Chaplin Cres.
Demonstrator in Mechanical Engineering

D. C. Robinson, B.A.Sc. — 25 Dearbourne Ave.
Demonstrator in Mechanical Engineering

T. S. Sipos, B.Sc. (Indiana) — 681 Spadina Ave.
Demonstrator in Mechanical Engineering

I. D. Smith, B.A.Sc. — 17 Elmwood Ave.
Demonstrator in Mechanical Engineering

B. J. Wiacek, B.A.Sc. — 409 Manning Ave.
Demonstrator in Mechanical Engineering

DEPARTMENT OF METALLURGICAL ENGINEERING

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Professor of Metallurgical Engineering

B. Chalmers, D.Sc., Ph.D. (Lond.) — 84 Douglas Ave., Oakville
Professor of Metallurgical Engineering

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Associate Professor of Ceramics

H. U. Ross, M.Sc. (McG.) — 3857 Bathurst St.
Assistant Professor of Metallurgical Engineering

E. Thall, B.A.Sc. — 174 Falkirk Ave.
Lecturer in Metallurgical Engineering

Miss M. F. Satterly, B.A., M.F.A. (Alfred) — 95 Bernard Ave.
Demonstrator in Ceramics

DEPARTMENT OF MINING ENGINEERING

R. E. Barrett, B.Sc. (McG.) — 116 Ridge Dr.
Professor of Mining Engineering

S. E. Wolfe, M.A.Sc. — R.R. No. 1, Streetsville
Associate Professor Mining Engineering

W. A. M. Hewer, B.A.Sc. — 68 Kingsway Cresc.
Assistant Professor Mining Engineering

J. W. E. Berridge, B.A.Sc. — 169 Hillsdale Ave. E.
Demonstrator in Mining Engineering

F. S. Dunn, B.A.Sc. — 247 St. Clements Ave.
Demonstrator in Mining Engineering

E. E. G. Heaslip, B.A.Sc. — 97 Woodycrest Ave.
Demonstrator in Mining Engineering

G. H. Matheson, B.Eng. (Adelaide, S. Aust.) — 66 Lowther Ave.
Demonstrator in Mining Engineering

D. W. Mitchell, B.Sc. (Lond.) — 81 Madison Ave.
Demonstrator in Mining Engineering

L. T. Nicholls, B.Eng. (Adelaide, S. Aust.) — 66 Lowther Ave.
Demonstrator in Mining Engineering

OTHER SPECIAL LECTURERS

R. R. Grant, O.L.S., F.C.A. — 102 Blythwood Rd.
Special Lecturer in Accountancy and Business

P. H. Mills, B.A.Sc. — 80 King St. W.
Special Lecturer in Engineering Law

PROFESSORS OF OTHER FACULTIES GIVING INSTRUCTION TO STUDENTS IN APPLIED SCIENCE

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S. Beatty, M.A., Ph.D., F.R.S.C. — 537 Markham St.
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SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture. On July 1, 1948, the School of Architecture was separated from the Faculty and became an independent School with its own Director and Council.

With the end of the Second World War during the summer of 1945 the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors and the President, the University leased from the Crown part of the large shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in the First Year and 1500 in the Second Year. In the 1947-48 session the enrolment at Ajax consisted of 1200 students in the First Year and 1400 in the Second Year. In the session 1948-49, 600 were registered at Ajax in the First Year and 975 in the Second Year. All other instruction was given in Toronto.

To provide for this self-contained University community at Ajax, there were 446 acres and 111 buildings. The University operated such services as central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence, in 1947-48 there were 1800 students and in 1948-49 there were 900. Student life at Ajax compared favourably with that in Toronto, excellent accommodation being provided for a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

With the completion of the Wallberg Building and the extension of the Mechanical Building, additional accommodation became available on the Queen's Park Campus, and this fact coupled with the decrease in numbers entering each year brought about the closing of Ajax on May 31, 1949.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

CHANGE IN ADMISSION REQUIREMENTS

Applicants for admission to the Faculty of Applied Science and Engineering are required to have at least third class honours in each subject of their Grade XIII examination.

GENERAL

1. Candidates for admission in 1951 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

Students from foreign countries must, in addition to providing the necessary equivalent certificates, give evidence of their ability to understand lecture and laboratory courses where the English language is used exclusively, and must demonstrate their ability to use this language in both the spoken and written form, with reasonable facility. Such students are strongly advised to spend a year in Grade XIII of an Ontario Secondary School before seeking admission to this Faculty.

3. Requirements for applicants presenting Ontario certificates.

SECONDARY SCHOOL GRADUATION DIPLOMA

No subjects are definitely prescribed, but the diploma must show credit in English and History, and in four of the optional subjects.

GRADE XIII

Third Class honours are required in each subject.

ENGLISH

MATHEMATICS (Algebra, Geometry, Trigonometry)

SCIENCE (Chemistry and Physics)

One of FRENCH
GERMAN
GREEK
ITALIAN
LATIN
SPANISH

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are advised to select German as one of the admission subjects.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate, generally known as Junior and Senior Matriculation respectively, may be accepted in so far as they meet the admission requirements of the University of Toronto in subjects and percentages and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

Province of Quebec
Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

Province of New Brunswick
Junior and Senior Matriculation certificates.

Province of Nova Scotia
High School certificates of Grade XI and Grade XII issued or endorsed by the Department of Education.

Province of Manitoba
The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of British Columbia
The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

Province of Prince Edward Island
Second and Third Year certificates issued by the Prince of Wales College.

Province of Alberta
The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of Saskatchewan
The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Newfoundland
Grade XI certificates of the Council of Higher Education (for Ontario Grade XII only).

Newfoundland and the Maritime provinces
Certificates of the Common Examining Board.

Great Britain
The Oxford and Cambridge Joint Board School certificate, or equivalent, indicating "Credit" or better standing in English Language and Literature, "Advanced" or "Additional" Mathematics, Physics, Chemistry (not general science), and a foreign language.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 17th to 26th (Saturday, September 22nd, 9 a.m. to 12 noon), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

Schedule of Fees

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
First, Second, Third	$300	$44	$344	$194	$153
Fourth	300	54	354	204	153
Women					
First	$300	$30	$330	$180	$153
Second, Third	300	27	327	177	153
Fourth	300	37	337	187	153

*The Academic Fee includes the following fees:—
Tuition; Library, Laboratory Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Degree (for the final year only): Hart House; Students' Administrative Council; Athletic; Health Service; Physical Education; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For women—Degree (for final year only); Students' Administrative Council; Athletic; Health Service; Physical Education (for the First Year only): Engineering Society; and Laboratory Deposit.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

DEGREE FEE

11. Each candidate for the degree of Bachelor of Applied Science must pay a fee of $10.00 to the Chief Accountant on or before the opening date of the session.

LABORATORY DEPOSIT

12. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

13. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 26.
2. Board and Lodging, per week.................. $15 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are eleven courses in Engineering, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8),
Ceramic Engineering (Course 8a),
Mining Geology (Course 9),
Aeronautical Engineering (Course 10),
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the above courses.

3. The courses extend over four academic years. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering may proceed to post-graduate and professional degrees. The post-graduate degrees are M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 137. Many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The course for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 205 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English, and Engineering and Society; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked

with the graduate courses (page 205), and with the work of the School of Engineering Research (page 30).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, and Doctor of Philosophy, see pages 205 and 206 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 119.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (see subject 690.)

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above-mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 205. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	9	–	4
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Applied Physics	75, 76	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	284	–	9	–	6
Hydraulics, Elementary	447	1	–	–	–
Least Squares	494	–	–	1	2
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Practical Astronomy	200	1	–	2	–
Practical Experience	690	–	–	–	–
Surveying	714, 716	1	6	1	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Cements and Concrete	35, 44	1	3	1	–
Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	9	–	9
Business	310	–	–	1	–
Construction Surveying	718	–	–	2	–
Control Surveys and Mapping	201	–	–	2	–
Differential Equations	507	1	–	1	–
Engineering Geology	382, 383	2	1	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Machinery	463, 464	2	3	–	–
Modern World History	324	2	–	–	–
Photogrametry	81	1	–	–	–
Physical Metallurgy	546	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Highway Engineering	217	1	–	1	–
Hydraulics	445, 446	2	3	2	3
Industrial Management	318	1	–	1	–
Mechanics of Materials Lab.	38, 50	–	3	–	3
Modern Political and Economic Trends	325	–	–	1½	–
Municipal Administration and Contracts	216	1	–	1	–
Philosophy of Science	326	2	–	–	–
Practical Experience	690	–	–	–	–
Profession of Engineering	327	–	–	½	–
Sanitary Engineering	214, 215	1	3	1	3
Soil Mechanics and Foundations	40, 299	2	–	1	3
Railway Engineering	218	1	–	1	–
Reinforced Concrete	41, 299	1		1	
Structural Design	43, 299	2	6	1	6
Theory of Structures	36, 299	2		2	
Thesis	730	–	–	–	2

MINING ENGINEERING

(Course 2)

The course in Mining Engineering provides a broad training in the fundamentals of engineering.

The graduate is therefore well prepared to enter any of the many phases of the mineral industry such as the exploration and development of new mineral areas, the mining of mineral deposits by both surface and underground methods, and the milling and metallurgical treatment of the ores and products. The field of the engineer in the mining of precious metals, copper, lead, zinc and nickel in Canada is now augmented by the production of iron, titanium and uranium. Engineering is also increasingly important in the mining and treatment of industrial minerals such as asbestos, limestone and gypsum. Moreover, the expanding world market for mineral products is necessitating the utilization of ore deposits which require the application of the most advanced technological methods.

The course in Mining combines in well balanced proportions, studies in the fields of mathematics, geology, chemistry, structures, mechanics, electricity, metallurgy, and economics and business, together with courses having particular reference to mining. In view of the large proportion of mining graduates employed in production and supervision, the administrative viewpoint is emphasized throughout the course.

With such diversified training, the Mining Engineer is capable of successful participation in all branches of industry and commerce.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 119.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded

Further information appears on page 205 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	1	–	1	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining Laboratory	165	–	–	–	2
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	6
Chemistry	224	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	6	–	6
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	3
Mineralogy and Lithology	386, 387	2	2	2	2

SECOND YEAR SUBJECTS COURSE 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	6	1	–
Theory of Measurements	190	1	–	–	–

THIRD YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	–	1	6
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Cements and Concrete	35	1	–	1	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	–
Geological Field Work	409	–	–	–	–
Hydraulics	440, 441	2	$1\frac{1}{2}$	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399	2	–	2	–
Mineral Dressing	180, 182	2	–	2	6
Mining	168	1	–	1	–
Mining Laboratory	169	–	3	–	–
Modern World History	324	2	–	–	–
Physical Chemistry	236	2	–	2	–
Political Science	323	–	–	2	–
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Structural Geology	397, 398	1	3	1	3
Summer Essays	192	–	–	2	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geological Field Trips	412	–	1	–	–
Glacial Geology	384	1	–	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Operation and Management	170	2	–	2	–
Mine Ventilation	175, 176	2	3	–	–
Mining Laboratory	172	–	–	–	6
Mining Geology	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Ore Dressing	183, 184	1	6	1	–
Physical Metallurgy	549	1	–	1	–
Practical Experience	691	–	–	–	–
Precambrian Geology	403	2	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	193	–	2	–	–
Philosophy of Science	326	2	–	–	–
Summer Essays	192	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(COURSE 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 119.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similiar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 205. The Calendar of the School of Graduate Studies should be consulted for details.

Graduate work leading to an advanced degree in the administrational or business aspects of engineering is also available in the Department of Mechanical Engineering. The thesis subject chosen for this purpose must be in the technological field and intending applicants are advised to obtain the approval of the Head of the Department of Mechanical Engineering before selecting their thesis topics.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	1½
Calculus	491	2	–	2	–
Descriptive Geometry	273	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Mechanical Engineering	461	2	–	2	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines A	465	2	–	2	–
Treatment of Technical Data	449	–	–	2	–

Third Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345	–	–	2	–
Alternating Currents........	340	2	–	–	–
Business..................	310	–	–	1	–
Electrical Laboratory.........	346	–	3	–	3
Elementary Structural Engineering..............	29, 292	1	3	1	3
Heat Engineering............	422	2	–	2	–
Heat Engines, Theory........	421, 423	2	3	2	3
Hydraulics.................	440, 441	2	–	2	3
Machine Design.............	467, 468	2	9	2	6
Modern World History.......	324	2	–	–	–
Physical Metallurgy..........	532	1	–	1	–
Political Science.............	323	–	–	2	–
Practical Experience..........	692	–	–	–	–
Theory of Machines B........	466	2	–	–	–

Fourth Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics.......	313	–	–	1	–
Engineering Law.............	314	1	–	–	–
Heat Engine Laboratory......	426	–	5	–	5
Heat Power Engineering......	424	2	–	2	–
Physical Metallurgy II.......	547, 548	1	–	1	1½
Hydraulics.................	442, 443, 444	2	5	3	6
Industrial Management.......	318	1	–	1	–
Internal Combustion and Air-Craft Engines...........	425	1	–	1	–
Machine Design.............	473, 474	2	5	2	6
Modern Political and Economic Trends.........	325	–	–	1½	–
Philosophy of Science.........	326	2	–	–	–
Practical Experience..........	692	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Structural Engineering........	46, 300	2	3	–	–
Thesis.....................	732	–	1	–	1

ENGINEERING PHYSICS

(Course 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 23 and 134 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 119.

GRADUATE STUDY

Graduates of this University, or of another University of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students with the necessary qualifications wishing to pursue further studies, may proceed to the M.A.Sc. and Ph.D. in the Departments of Engineering Physics, Electrical Engineering, Mechanical Engineering, Aeronautical Engineering, Metallurgical Engineering or, to the M.A. and Ph.D. in the Department of Physics.

The requirements and programme will be arranged through the Department concerned.

For further information see page 205 of this Calendar and the Calendar of the School of Graduate Studies.

First Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	6	–	3
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits	354, 356	2	1½	2	1½
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	6	–	3
Physical Training	640	–	2	–	2

Third Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Electronics	366, 379	2	–	2	3
Machine Design	471, 472	1	3	1	3
Modern World History	324	2	–	–	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	549	1	–	1	–
Physics of Solids and Fluids	656	1	–	1	–
Political Science	323	–	–	2	–
Thermodynamics and Kinetic Theory	657	3	–	3	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5e, Electricity					
Electrical Machines	377, 378	2	3	2	3
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Geometrical Optics	660, 661	1	3	1	–
Option 5g, Geophysics					
Engineering Geology	382, 383	2	1	2	2
Option 5t, Thermodynamics					
Hydraulics	450	1	–	1	–
Theory of Heat Engines	421, 423	2	3	2	3

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5e, Electricity					
Acoustics	97, 98	2	1½	–	–
Atomic Physics	663	3	–	3	–
Circuit Analysis	351	2	–	2	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Engineering Electronics	357, 358	2	1½	1	1½
Transmission at Low and High Frequency	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Ultra-High Frequency Communication	371, 372	–	–	2	1½
Option 5s, X-Rays and Spectroscopy					
Analysis of Materials by Spectrographic and X-Ray Methods	669	1	–	1	–
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	2	–	2	–
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	9	–	9
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5g, Geophysics					
Atomic Physics	663	3	–	3	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 672	2	6	2	6
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Deposits	399	2	–	2	–
Mining Geology (Part)	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	397, 398	1	3	1	3
Thesis Seminar	733	–	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics	89, 90	2	3	2	6
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Photometry and Illumination Design	95, 96	2	3	2	6
Physical Laboratory	674	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5t, Thermodynamics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Machines	377, 378	2	3	2	3
Heat Engineering Laboratory	426	–	6	–	6
Heat Power Engineering	424	2	–	2	–
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	–	1	–
Low Temperature Physiology	211, 212	1	3	1	3
Machine Design	478	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Vibration Engineering	99, 100	1	3	1	3

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(Course 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more useful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical literature. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 119.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Chemical Engineering is required to submit satisfactory evidence of having had 800 hours' practical experience. (See subject 694).

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 205 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	223	–	–	–	9
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	9	–	3
English	610	1	–	1	–
German	613	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	694	–	–	–	–
Statics	20	1	–	2	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Engineering Problems	233	–	–	–	3
Chemical Laboratory I	232	–	9	–	–
Chemical Laboratory II	235	–	–	–	9
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	3
German	614	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	2	–

Second Year Subjects Course 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry	231	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234	2	–	2	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	694	–	–	–	–

Third Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Business	310	–	–	1	–
Chemical Engineering	242	2	–	–	–
Chemical Engineering Laboratory	243	–	–	–	3
Chemical Engineering Problems	248	–	–	–	3
Chemical Theory	240	–	–	2	–
Electrochemistry	246, 247	2	1½	–	–
Heat Engines, Theory	421, 428	2	–	2	1½
Hydraulics	440, 441	2	3	2	–
Industrial Chemistry	241, 249	1	–	1	12
Modern World History	324	2	–	–	–
Organic Chemistry	244, 245	2	9	2	–
Political Science	323	–	–	2	–
Practical Experience	694	–	–	–	–
Public Speaking	319	1	–	1	–

Fourth Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	1	–	1	–
Chemical Engineering Problems	255	–	1	–	1
Chemical Laboratory	251	–	14	–	–
Chemical Theory	259	1	–	1	–
Engineering Law	314	1	–	–	–
Graphical Methods in Chemical Engineering	254	–	1	–	1
Industrial Chemistry	258	1	–	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	–	–	1½	–
Organic Chemistry	257	1	–	1	–
Philosophy of Science	326	2	–	–	–
Practical Experience	694	–	–	–	–
Profession of Engineering	327	–	–	½	–
Public Speaking	319	1	–	1	–
Thermodynamics	256	1	–	1	–
Thesis	734	–	6	–	19

ELECTRICAL ENGINEERING

(Course 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 119.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

For the degree of Master of Applied Science at least one year of full-time study is required. From one-half to two-thirds of this time is devoted to lecture subjects in advanced studies chosen according to instructions contained in the Calendar of the School of Graduate Studies. The remainder is devoted to a research project for which a thesis must be submitted.

Further information appears on page 205. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	9	–	4
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491, 286	2	3	2	3
Descriptive Geometry	273	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–

Third Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342, 343	2	4	–	–
Electrical Problems	335	–	2	–	4
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Application in Electricity Engineering	336	–	–	3	–
Modern World History	324	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	–	–	2	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	4½	–	1½
Electrical Problems and Seminar	359	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	1½	1	1½
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	2	–	2	–
And one of the following groups of subjects:					
Group A					
Acoustics	82, 83	–	–	2	1½
Communications II	362, 363	–	–	3	3
Ultra-High Frequency Communications	371, 372	–	–	2	1½
Group B					
Alternating-Current Machinery II	369, 370	–	–	2	1½
Electrical Design	373, 374	–	–	2	2
Illumination	93, 94	–	–	2	3

METALLURGICAL ENGINEERING

(COURSE 8)

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

Both physical and extractive metallurgy are based upon the sciences of chemistry and physics. It is believed that a wider knowledge of the basic sciences will bring to the student a readier appreciation of the technical problems with which he will be later confronted and a greater facility in their solution. To achieve this end, greater emphasis is placed upon physics and chemistry in the earlier years of the course. It follows that this course will be of greater value to students who have obtained a good standing in mathematics and science. In addition to instruction in extractive and physical metallurgy, engineering subjects are provided to give a general knowledge of mechanics of materials, machine design, etc. The course includes the non-technical subjects, such as Economics and English, which are common to all courses in the Faculty.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical Metallurgy courses cover the structure and properties of alloys, including microscopic, x-ray and mechanical methods of investigation.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 119.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 205 and in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Applied Mechanics	24	2	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Chemistry	225,228	1	–	1	6
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	287	–	3	–	3
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23,31	2	3	2	–
Metallurgy	530	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6

Third Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Differential Equations	507	1	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	1½	3	–	–
Metallurgical Problems Laboratory	531	–	2	–	2
Metallurgical Theory	239	2	–	2	–
Mineral Dressing	180	2	–	2	–
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Principles of Extractive Metallurgy	534, 535	2	6	1	6
Principles of Physical Metallurgy	536, 537	2	3	2	3

Fourth Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgical Theory	550	1	–	1	–
Metallurgical Problems Laboratory	540	–	2	–	2
Metallurgy Laboratory	541	–	6	–	–
Modern Political and Economic Trends	325	–	–	1½	–
Non-Ferrous Production Metallurgy	542	2	–	2	–
Ore Dressing	183	1	–	1	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	543, 544	2	6	2	3
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	736	–	4	–	13

CERAMIC ENGINEERING

(COURSE 8a)

The course in Ceramics offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

In the manufacture of fused silicates, such as glasses, glazes and enamels, both clear and coloured and in the manufacture of special bodies such as those used for thermal and electrical insulation, practically every chemical element obtainable on a commercial basis may be used. The subject matter is essentially inorganic chemical engineering with an emphasis upon high temperature chemistry. The natural field of employment for graduates would be for the technical, production, sales and research divisions of the industry.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 119.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry and others approved by the School of Graduate Studies, while the remainder will be devoted to research in the same phase of the ceramic field.

Further information appears on page 205. The Calendar of the School of Graduate Studies should be consulted for further details.

First Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Applied Mechanics	24	2	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3

Second Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Chemistry	225, 228	1	6	1	–
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	287	–	3	–	3
Industrial Chemistry	230	1	–	2	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	250	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6

Third Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	162	–	1½	–	–
Business	310	–	–	1	–
Ceramic Minerals and Calculations	560	4	–	2	–
Ceramics	562	–	–	2	–
Chemical Theory	240	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	1½
Heavy Clay Products Laboratory	561	–	3	–	6
Hydraulics	440, 441	2	3	–	–
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Dressing	180	2	–	2	–
Modern World History	324	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	–	–	2	–

Fourth Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Glass and Enamels	566	1	–	1	–
Hydraulics (1951-52 only)	440, 441	2	3	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Mineral Deposits	399	2	–	2	–
Mineral Dressing (1951-52 only)	180	2	–	2	–
Mineral Dressing Laboratory	182	–	–	–	6
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Refractories and Ceramic Bodies	565	2	–	1	–
Thesis	737	–	13	–	13
Whitewares and Enamels Laboratory	568	–	6	–	6

MINING GEOLOGY

(Course 9)

The course in Mining Geology is designed for those who wish to enter the field of applied geology. It provides a training in the fundamentals of the geological sciences, and a graduate in this course will be suitably trained to enter any of the branches of geology such as mining geology, engineering geology, petroleum geology, or field and exploration work for mining and oil companies.

The first year of the course in Mining Geology is identical with that in Mining Engineering. In the remaining years, while the emphasis is on geology, instruction is also given in the allied engineering fields. In this way the student in Geology is given a basic engineering training and an understanding of the extractive industries of mining and metallurgy.

The geological courses in the first and second years cover the general fields of physical geology, historical and stratigraphic geology, and minerals and rocks. The third and fourth years are spent in concentrated work on specialized topics as ore deposits, petroleum and structural geology, palaeontology, microscopic study of rocks and ores, Precambrian geology, glacial geology, mining geology, geology of Canada, and geophysics.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 119.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a M.A.Sc. or Ph.D.

Work for such degrees will include the preparation of a thesis on an approved subject, together with the study of advanced courses.

Further information appears on page 205. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining Laboratory	165	–	–	–	2
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	6
Chemistry	224	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	287	–	3	–	3
Geological Field Trips	410	–	–	–	–
Heat Engines, Elementary	420	1	–	–	–
Historical and Stratigraphical Geology	393, 394	2	2	2	2
Mechanics of Materials	23, 31	2	–	2	1
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	6	1	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Elementary Geochemistry	385	2	–	2	–
Geological Field Trips	411	–	–	–	–
Geological Field Work	409	–	–	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399, 400	2	3	2	3
Mineral Dressing	186	2	–	–	–
Mining	168	1	–	1	–
Modern World History	324	2	–	–	–
Palaeontology	395, 396	2	2	2	2
Petrology	391, 392	2	2	2	2
Political Science	323	–	–	2	–
Practical Experience	696	–	–	–	–
Structural Geology	397, 398	1	3	1	3
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mineralogy	388	2	–	2	–
Engineering Economics	313	–	–	1	–
Geology of Canada	401, 402	2	–	1	2
Geological Field Trips	412, 413, 414	–	1	–	–
Geophysics	671, 673	1	3	1	3
Glacial Geology	384	1	–	1	–
Mine Operation and Management	170	2	–	2	–
Mining Laboratory	172	–	–	–	6
Mining Geology	405, 406	1	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Petroleum Geology	407, 408	2	–	1	3
Practical Experience	696	–	–	–	–
Precambrian Geology	403, 404	2	–	–	3
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Thesis	738	–	6	–	–

AERONAUTICAL ENGINEERING

(Course 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 23 and 134 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 119.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leadingto a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 205. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Aeronautics	1	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	274	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	286	–	3	–	3
Heat Engines, Elementary	420	1	–	–	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	2	–	2	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	1	3	1	3
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Electrical Engineering	375, 376	2	3	2	3
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	3	2	6
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Hydraulics	452	1	–	–	–
Aircraft Propulsion	11	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Gas Dynamics	26	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(Course 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderantly engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Calculus 491, page 119.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course (see Practical Experience, 698, page 130).

First Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	1½
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	273	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	3	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	6	–	8
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	532	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–

Third Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	1	2	1
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

Fourth Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	2	3	–	–
Business Policy	309	3	2	3	2
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Illumination and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy II	547, 548	1	–	1	1½
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	–	–	2	3
Thesis	740	–	1	–	1

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 34.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, II Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text book: Technical Aerodynamics—K. D. Wood.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamic theory, in which the following topics are discussed: performance estimation and calculation, airfoil theory, propellors, wind tunnel corrections, drag, stability and control, spinning, rotary wing aircraft, compressibility effects.

Text books: Applied Aerodynamics—Bairstow. Airfoil and Airscrew Theory—Glauert. Aerodynamics of the Airplane—Millikan. Aerodynamics Theory—Durand.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon, W. H. Jackson, W. Czerwinski, R. D. Hiscocks, D. G. Allan.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

The preliminary design of light aircraft is discussed in these lectures. It is intended to give the student a grasp of the principles of balance and load distribution necessary for the design of the various components. About three quarters of these lectures are given in a class room, the remainder being given in the laboratory where practical work is carried out.

Text books: Civil Airworthiness Requirements (British). Civil Aeronautics Manual 04 (U.S.).

6. Airplane Design and Layout Laboratory. T. R. Loudon, W. H. Jackson, W. Czerwinski, D. G. Allan.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

This course is divided roughly into three periods devoted respectively to the preliminary design of light aircraft, fitting design and layout and final design of a light aircraft project which is actually constructed under the supervision of skilled aircraft mechanics. The course gives the practical application of the lectures in course 5.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Analysis and Design of Airplane Structures—Bruhn. Aircraft Structures—Peery. Airplane Structures—Niles and Newell.

8. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 3 hrs. laboratory per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. Some of this work is taken in conjunction with light aircraft design in laboratory work described in subject 6.

9. Airplane Stress Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

These lectures serve as an introductory course to the advanced structural analysis used in aircraft design in the fourth year.

Text books: Analysis and Design of Airplane Structures—Bruhn. Fundamentals of Aircraft Structures—Barton.

10. Airplane Stress Analysis Laboratory. T. R. Loudon.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aircraft Propulsion. R. B. McIntyre.

Course 10, IV Year; 1 hr. lecture per week, both terms.

This course of lectures deals with theory of the propeller. The principles of operation of the reciprocating engine, turbo jet, gas turbine and rocket are explained.

12. Aircraft Layout. W. Jackson, R. D. Hiscocks.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 6, 7, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures.

Text book: Applied Statics—Loudon.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith, F. C. Hooper, J. M. F. Vickers.

Courses 1, 3, 7, and 11, II Year; 1 hr. lecture per week, both terms.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Reference book: Mechanics—Den Hartog.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text book: Resistance of Materials—Seely.

24. Applied Mechanics. T. R. Loudon, B. Etkin.

Courses 5, 8, 8a, and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed structures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text books: Applied Statics—Loudon. Principles of Physics, Mechanics—Sears.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vectors; general plane motion of particles systems of particles, and rigid bodies; compound pendulum, centre of percussion, gyroscopes.

Text books: Engineering Mechanics (vol. 2)—Timoshenko and Young. Principles of Mechanics—Synge and Griffiths.

26. Gas Dynamics. G. N. Patterson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods. Some instruction will be given at the Institute of Aerophysics.

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Introduction to the operators curl, div. and grad. Plane and Space dynamics using the vector rotation. Euler's equation for a rigid body. Lagranges equations. Vibrations. Dimensional analysis and model testing.

Text books: Principles of Mechanics—Synge and Griffiths. Engineering Mechanics (vol. 2)—Timoshenko and Young.

28. Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young and Morrison. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. C. F. Morrison, M. W. Huggins.

Courses 2, 3, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9, and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Vector operators; classical equations for perfect fluids, velocity potential, stream function, complex potential. Vorticity, circulation, flow past cylinder with lift. Hydraulic machinery, torque converter. Simple cases of viscous flow.

Text books: Treatise on Hydromechanics—Ramsay. Airfoil and Airscrew Theory—Glauert. Fluid Mechanics—Hunsaker and Rightmire.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Courses 1 and 2, III year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Suther-

land and Clifford. Reinforced Concrete Construction, Vol. I—Hool Elementary Structural Engineering—Urquhart and O'Rourke.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

40. Soil Mechanics and Foundations. T. R. Loudon, W. L. Sagar.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

The design of foundations, retaining walls and dams is discussed in detail preliminary to working out problems in the laboratory.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer. Design of Concrete Structure—Urquhart and O'Rourke.

41. Reinforced Concrete. M. W. Huggins.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

43. Structural Design. M. W. Huggins.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, cableways, headframes, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum. Structural Problems—Young and Morrison.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 3 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, second term.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson. Structural Problems—Young and Morrison.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. J. T. N. Atkinson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics—Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. J. T. N. Atkinson.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

75. Applied Physics. J. T. N. Atkinson

Course 1, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. J. T. N. Atkinson

Course 1, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 75.

81. Photogrametry. K. B. Jackson.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Acoustics. V. L. Henderson.

Course 7, IV Year; 2 hrs. lectures per week, second term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference book: Elements of Acoustical Engineering—Olson.

83. Acoustics Laboratory. V. L. Henderson.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Supplementing course 82.

89. Architectural Acoustics. V. L. Henderson.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

Reference book: Acoustical Designing in Architecture—Knudsen and Harris.

90. Architectural Acoustics Laboratory. V. L. Henderson.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 89.

91. Illumination and Acoustics. V. L. Henderson, E. L. Dodington.
Course 11, IV Year; 1 hr. lecture per week, both terms.
The production of light and the engineering principles underlying its utilization.
The generation and control of sound.
Reference book: Less Noise Better Hearing—Sabine.

92. Illumination and Acoustics. V. L. Henderson, E. L. Dodington.
Course 11, IV Year; 1½ hrs. laboratory per week, both terms.
A laboratory course supplementing course 91.

93. Illumination. E. L. Dodington.
Course 7, IV Year; 2 hrs. lecture per week, second term.
Illuminating Engineering dealing with the nature, measurement, and production of light and related radiations.
Theory of human vision; the design and application of lighting equipment for visual efficiency and comfort. Fundamentals of power supply.

94. Illumination Laboratory. E. L. Dodington.
Course 7, IV Year; 3 hrs. per week, second term.
Supplementing subject 93.

95. Photometry and Illumination Design. E. L. Dodington.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. E. L. Dodington.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 95.

97. Acoustics. V. L. Henderson.
Course 5e, IV Year; 2 hrs. lectures per week, first term.
Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.
Reference book: Elements of Acoustical Engineering—Olson.

98. Acoustics Laboratory. V. L. Henderson.
Course 5e, IV Year; 1½ hrs. laboratory per week, first term.
Supplementing subject 97.

99. Vibration Engineering. V. L. Henderson.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ASSAYING, MINING AND ORE DRESSING

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved. but also upon the errors inherent in operators as well as in methods,

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich. The Sampling and Assay of the Precious Metals—E. A. Smith.

161. Assaying Laboratory. M. Hewer.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

The determination of precious metals. Scorification, crucible and combination wet and dry methods of assaying ores both simple and complex; milling and metallurgical products including cyanide solutions, cyanide precipitates and gold bullion. Attention is also given to the sampling and assay of ores containing radio-active minerals.

162. Assaying Laboratory. M. Hewer.

Course 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lectures periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for ceramic engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. The Staff in Mining Engineering.

Courses 2 and 9, I Year; 2 hrs. per week, second term.

A combined laboratory and lecture course. It is an introduction to the principles of mining and sampling calculations.

166. Mining. R. E. Barrett.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
A course of lectures relating to underground and surface mining methods, rock boring machinery and practice.

168. Mining. R. E. Barrett.
Courses 2 and 9, III Year; 1 hr. lecture per week, both terms.
Methods of mine development by mine adits, shafts, drifts and crosscuts; stoping methods, loading, and underground transportation.

169. Mining Laboratory. S. E. Wolfe.
Course 2, III Year; 3 hrs. laboratory per week, first term.
Special mining problems are given relating to sampling, diamond drilling, stope measurements, the factors affecting the angle of repose of broken materials and the behaviour of such materials when in motion. To develop the individual students' initiative, some special survey problems are worked in the laboratory.

170. Mine Operation and Management. R. E. Barrett.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, both terms.
Lectures on advanced mining practice, deep mining problems, mine mechanization, underground crushing, hoisting and communications, mine safety and hygiene, mine plant and layout, mining company structure and financing, cost statements, incentive wage plans, and various aspects of labor relations such as labor legislation, unions and collective bargaining.

172. Mining Laboratory. R. E. Barrett.
Courses 2 and 9, IV Year; 6 hrs. laboratory per week, second term.
Problems in mine layout involving shaft location and size; mine development; choice of stoping methods, mining rate, and mine equipment; time and cost schedules; ore reserve calculations.

175. Mine Ventilation and Allied Problems. G. R. Lord.
Course 2, IV Year; 2 hrs. lectures per week, first term.
Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

176. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.
Course 2, IV Year; 3 hrs. laboratory per week, first term.
Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

180. Mineral Dressing. S. E. Wolfe.

Courses 2, 8, and 8a, III Year; Course 8a, IV Year (1951-52 only); 2 hrs. lectures per week, both terms.

The course deals with the economics of, the theoretical principles and their practical application in, the treatment of ores and mineral aggregates. These involve the processes of crushing, grinding, sizing and classification; gravity, magnetic, and electrostatic separation; and an introduction to froth flotation. In addition, ancillary processes are studied. These include flocculation, sedimentation, filtration, drying of mineral products and the precipitation and collection of dust and fume.

182. Mineral Dressing Laboratory. S. E. Wolfe.

Course 2, III Year; Courses 8 and 8a, IV Year; 6 hrs. laboratory per week, second term.

This work is coordinated with the lecture course 180. Studies are made of crushing machinery, the principles of crushing and grading of rock products, screen analysis, and the sampling of broken material and mill products. Certain tests with gravity concentrating machines are made and an introduction to the technique of flotation test work is given.

183. Ore Dressing. S. E. Wolfe.

Course 2 and 8, IV Year; 1 hr. lecture per week, both terms

The subjects covered are extensions of those in 180 and 182; cyanidation, flotation processes and technique, the current practice at milling plants, and problems associated with milling.

184. Ore Dressing Laboratory. S. E. Wolfe.

Course 2, IV Year; 6 continuous hours per week, first term.

Advanced work coordinated with lecture course 183 and pertaining to ore dressing appliances, the handling in bulk of finely divided solids, the selective flotation of sulphides, ore testing, and pilot plant mill runs.

186. Mineral Dressing. S. E. Wolfe.

Course 9, III Year; 2 hrs. lectures per week, first term.

This abridged course deals with current practice and fundamental principles in the field of mineral beneficiation.

190. Theory of Measurements. M. Hewer.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

Engineering work requires the practical utilization of measurements which have varying degrees of precision. This course deals with the philosophy underlying the causes of errors, their effect and relative importance upon computed results, and the interpretation of numbers to represent measurements. The use of charts and

graphs to illustrate certain measurements and the derivation of empirical equations from these charts is also considered.

192. Summer Essay. R. E. Barrett.

Course 2, III Year: IV Year (1951-52 only).

An essay, or report, written on a mining subject, preferably some phase of work with which the student is associated during summer employment. Subsequently, each student will deliver a talk to his class on the subject chosen. Thus, training is afforded in both technical writing and public speaking. Students are briefed in advance concerning requirements of this course.

193. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. J. W. Melson, H. L. Macklin.

Course 1, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

The derivation of formulae and their application to the solution of spherical triangles and practical problems. Practical determination of time, latitude and azimuth by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Text books: Nautical Almanac for current year and printed lecture notes.

201. Control Surveys and Mapping. O. J. Marshall.

Course 1, III Year; 2 hrs. lectures per week, second term.

Principles and Methods of control surveys involving triangulation, traverse, and levelling of various degrees of precision; elementary geodesy and map projections.

Text book: Advanced Surveying and Mapping—Whitmore.

Reference books: Higher Surveying—Breed and Hosmer, Vol. II, 6th Ed. Theory and Practice Surveying—Tracy.

BOTANY

211. Low Temperature Physiology. G. H. Duff.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.
Course 5t, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, W. M. Walkinshaw.
Course 1, IV Year; 3 hrs. per week, both terms.
Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration and Contracts. A. E. Berry, W. Storrie.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 299.
Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, also forms an essential feature of the instruction.
Text book: Engineering Law—Laidlaw and Young.

217. Highway Engineering. W. L. Sagar.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Principles governing the location, design, and construction of highways and airports.

218. Railway Engineering. W. M. Treadgold.
Course 1, IV Year; 1 hr. lecture per week, both terms.
Principles governing location, design and construction of railways.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. C. P. Brockett, W. F. Graydon.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.
Chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, W. F. Graydon.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 6 hrs. laboratory per week, one term.

A laboratory course illustrating the fundamental laws of chemistry as dealt with in the lecture course, and providing an introduction to chemical analytical methods.

223. Analytical Chemistry Laboratory. L. J. Rogers, W. F. Graydon.
Course 6, I Year; 9 hrs. laboratory per week, second term.
Systematic qualitative and quantitative inorganic analysis.

224. Chemistry. J. G. Breckenridge.
Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.
An introduction to modern theories of molecular structure, and to organic chemistry.

225 Analytical Chemistry. L. J. Rogers.
Courses 8 and 8a, II Year; Course 2, III Year; 1 hr. lecture per week, both terms.
Principles of chemical analysis; select volumetric and gravimetric methods; technical analysis.

226. Engineering Chemistry. The Staff in Chemical Engineering.
Courses 1, 3, 7, and 11, II Year; 1 hr. lecture per week, both terms.
Water-treatment, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. W. F. Graydon.
Courses 2 and 9, II Year; 6 hrs. laboratory per week, second term.
Volumetric and gravimetric analysis.

228. Analytical Chemistry Laboratory. L. J. Rogers.
Course 8a, II Year; 6 hrs. laboratory per week, first term.
Course 8, II Year; 6 hrs. laboratory per week, second term.
Gravimetric and volumetric methods, acidimetry and alkalimetry.
Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

230. Industrial Chemistry. E. A. Smith.
Courses 6 and 8a, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Course 11, II Year; 1 hr. lecture per week, both terms.
Manufacture of acids, alkalies, and inorganic chemicals; water-treatment, corrosion, explosives.

231. Inorganic Chemistry. C. P. Brockett.
Courses 6, 8 and 8a, II Year; 1 hr. lecture per week, both terms.
The constitution of matter and classification of the elements: systematic inorganic chemistry.
In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Modern Inorganic Chemistry—Parkes and Mellor: Chapters 8, 17-25, 35.

232. Chemical Laboratory I. E. A. Smith, W. G. MacElhinney.
Course 6, II Year; 9 hrs. laboratory per week, first term.

A laboratory course including several methods of technical analysis, selected standard analytical procedures, and instruction in glass-blowing.

In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Textbook of Inorganic Analysis—Kolthoff and Sandwell: Chapters 4-8, 13, 15, 28-31.

233. Chemical Engineering Problems. W. G. MacElhinney.

Course 6, II Year; 3 hrs. laboratory per week, second term.

An introductory course in industrial chemical calculations.

234. Organic Chemistry. J. G. Breckenridge.

Course 6, II Year; 2 hrs. lectures per week, both terms.

An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

235. Chemical Laboratory II. R. R. McLaughlin, J. G. Breckenridge, R. M. Husband.

Course 6, II Year; 9 hrs. laboratory per week, second term.

A laboratory course in organic chemistry to accompany subject 234.

236. Physical Chemistry. D. J. LeRoy, R. L. McIntosh.

Courses 2, 6, 8, and 8a, II Year; Course 2, III Year (1951-52 only); 2 hrs. lectures per week, both terms.

Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

Text book: Principles of Phase Equilibria—Wetmore and LeRoy.

237. Analytical Chemistry Laboratory. L. J. Rogers.

Course 2, III Year; 6 hrs. laboratory per week, second term.

Technical analysis of ores and furnace products; wet assaying.

239. Metallurgical Theory. W. C. Macdonald.

Course 8, III Year; 2 hrs. lectures per week, both terms.

A course dealing particularly with chemical theory as applied to metallurgical reactions.

240. Chemical Theory. R. R. McLaughlin, W. C. Macdonald.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term.

A discussion of the principles of adsorption and colloid chemistry; chemical equilibria.

241. Industrial Chemistry. E. A. Smith.

Course 6, III Year; III Year Honour Chemistry; 1 hr. lecture per week, both terms.

Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, fermentation industries, etc.

In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Chemical Process Industries—Shreve: Chapters 29, 30, 31, 37.

242. Chemical Engineering. W. C. Macdonald, G. W. Minard.
Course 6, III Year; 2 hrs. lectures per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.
In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Chemical Machinery—Riegel: Chapters 6, 8, 20, 21. Unit Operations—Brown: Chapters 11, 14, 18, 19, 32.

243. Chemical Engineering Laboratory. W. C. Macdonald, G. W. Minard.
Course 6, III Year; 3 hrs. laboratory per week, second term.
Experiments in chemical engineering to accompany part of subject 242.

244. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234.

245. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge, R. M. Husband.
Course 6, III; 9 hrs. laboratory per week, first term.
A laboratory subject accompanying lecture subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 2 hrs. lectures per week, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Courses 6 and 8, III Year; 18 hrs., first term.
Quantitative measurements to accompany subject 246.

248. Chemical Engineering Problems. W. G. MacElhinney.
Course 6, III Year; 3 hrs. laboratory per week, second term.
A continuation of subject 233.

249. Industrial Chemistry Laboratory. E. A. Smith, W. G. MacElhinney.
Course 6, III Year; 12 hrs. laboratory per week, second term.
A continuation of subject 232 including technical German translation.

250. Organic Chemistry. J. G. Breckenridge.
Courses 5 and 8a, II Year; 1 hr. lecture per week, both terms.
General reactions and methods of synthesis of carbon compounds.
Text book: Organic Chemistry. A Brief Course—Brewster.

251. Chemical Laboratory. Staff in Chemical Engineering.
Course 6, IV Year; 14 hrs. laboratory per week, first term.
A continuation of subject 243, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, organic, and analytical chemistry.

253. Chemical Engineering. G. W. Minard.

Course 6, IV Year; 1 hr. lecture per week, both terms.

A continuation of subject 242.

254. Graphical Methods in Chemical Engineering. G. W. Minard.

Course 6, IV Year; 1 hr. laboratory per week, both terms.

This subject gives the student instruction and practice in the use of elementary principles for constructing nomograms, and the derivation of empirical equations by graphical methods.

255. Chemical Engineering Problems. W. G. MacElhinney.

Course 6, IV Year; 1 hr. laboratory per week, both terms.

Calculations in connection with various problems in chemical engineering.

256. Thermodynamics. W. C. Macdonald.

Course 6, IV Year; 1 hr. lecture per week, both terms.

Chemical thermodynamics, dealing with problems in chemical engineering.

257. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.

Course 6, IV Year; 1 hr. lecture per week, both terms.

A continuation of subjects 234 and 244.

258. Industrial Chemistry. E. A. Smith, R. M. Husband.

Course 6, IV Year; 1 hr. lecture per week, first term.

IV Year Forestry; 1 hr. lecture per week, both terms.

Pulp and paper, and cellulose industries.

In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Chemical Process Industries—Shreve: Chapters 33, 34.

259. Chemical Theory. W. C. Macdonald.

Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A course on applied chemical kinetics and Phase Rule.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. A. Wardell.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, both terms.

These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines and planes.

Text book: Descriptive Geometry—Watts and Rule.

271. Descriptive Geometry. A Wardell.

Courses 5 and 10, I Year; 1 hr. lecture per week, both terms.

Course 270 with the addition of some work in curved surfaces.

Text book: Descriptive Geometry—Watts and Rule.

272. Descriptive Geometry. A. Wardell.

Course 1, II Year; 1 hr. lecture per week, both terms.

A continuation of lecture Course 270. Problems of curved surfaces, shades, shadows and perspective are discussed: also, an introduction is given to the principles of projection used in map making.

273. Descriptive Geometry. A. Wardell.

Courses 3, 7, 9, and 11, II Year; 1 hr. lecture per week, both terms.

A continuation of lecture course 270. Problems of curved surfaces, shades, shadows and perspective are discussed.

274. Descriptive Geometry. A. Wardell.

Course 10, II Year; 1 hr. lecture per week, both terms.

A continuation of lecture course 271. Problems of curved surfaces, shades, shadows and perspective are discussed with attention to problems of special interest to students in aeronautical engineering.

ENGINEERING PROBLEMS AND DRAWING

The courses in Engineering Problems and Drawing consist premarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems in the First and Second Years deal with the fundamental engineering studies—mathematics, applied mechanics, descriptive geometry, the plotting of surveys that have been made by the student in the field, theory of machines, while in the Third and Fourth Years, the problems deal mainly with design.

275. Engineering Problems and Drawing. A. Wardell.

Courses 1 and 7, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Courses 2 and 9, I Year; 6 hrs. per week, both terms.

Courses 3 and 11, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus.) Plotting or original surveys.

279. Engineering Problems and Drawing. A. Wardell.

Course 5, I Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Course 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.

Course 6, I Year; 9 hrs. per week, first term; 3 hrs. per week, second term.

Courses 8 and 8a, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Elementary drawing and lettering. The solving of problems in descriptive geometry, applied mechanics, and mathematics.

284. Engineering Problems and Drawing. A. Wardell.

Course 1, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing. A. Wardell.

Course 2, II Year; 6 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheets. Plotting of original surveys.

286. Engineering Problems and Drawing. A. Wardell.

Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.

Course 7, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Course 10, II Year; 3 hrs. per week, both terms.

Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of machines. Problems in mathematics (calculus).

287. Engineering Problems and Drawing. A. Wardell.

Courses 6, 8, 8a and 9, II Year; 3 hrs. per week, both terms.

Problems in mechanics of materials and mathematics. Flow sheets.

291. Engineering Problems and Drawing. W. B. Dunbar.

Course 1, III Year; 9 hrs. per week, both terms.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses.

292. Engineering Problems and Drawing. W. B. Dunbar.

Course 2, III Year; 3 hrs. per week, first term.

Course 3, III Year; 3 hrs. per week, both terms.

Course 8a, III Year; 3 hrs. per week, both terms.

Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.

Course 1, IV Year; 6 hrs. per week, both terms.

Advanced problems in design of steel and reinforced concrete structures—floor panels, mill buildings, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems in moment distribution in rigid frames, influence lines, and deflection of trusses.

300. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.

Course 3, IV Year; 3 hrs. per week, first term.

Course 11, IV Year; 3 hrs. per week, second term.

Problems in determination of stresses in, and design of mill building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. F. N. Beard.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

An introduction to the theory and practice of Accounting, the procedures followed in the preparation of financial statements, and the use of Accounting as a means of control.

307. Statistics. R. J. Sutherland.

Course 11, III Year; 2 hrs. lectures per week, both terms.

An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. V. W. Bladen.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

A survey of contemporary economic institutions and problems and the application of economic theory to income determination, money and banking,i ndustrial fluctuations, fiscal policy and labour problems.

309. Business Policy. A. W. Currie.

Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.

Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8a, and 9, III Year; 1 hr. lecture per week. second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. S. Triantis.

All courses, II Year; 2 hrs. lectures per week, both terms.

An Introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An introduction to Political Economy—Bladen.

313. Engineering Economics. J. W. Church.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management. R. E. Barrett.

Course 8, IV Year, 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of management, including labour relations, plant organizing, maintenance and safety.

318. Industrial Management. E. A. Allcut, C. E. Olive.

Courses 1, 3, 6, 7, and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and

economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.
Course 6, III Year; Course 6, IV Year; 1 hr. per week, both terms.

321. Industrial Management A. E. A. Allcut.
Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. laboratory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

322. Engineering and Society. R. H. Fleming.
All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. K. D. McRae.
All courses, III Year; 2 hrs. lectures per week, second term.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. H. I. Nelson.
All courses, III Year; 2 hrs. lectures per week, first term.

An outline of the chief trends and developments in selected key areas during the 19th and 20th centuries.

325. Modern Political and Economic Trends. W. E. Grasham.
All courses, IV Year; 18 lectures, second term.

A study of the theory and practice of modern economic and political trends.

326. Philosophy of Science. Marcus Long.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 2 hrs. lectures per week, first term.

The relation between Science and Philosophy; an examination of the presuppositions of science and its basic concepts; alternative accounts of the nature of the universe with their implications for social and moral behaviour.

327. The Profession of Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering.

328. Industrial Management B. C. E. Olive.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service, etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. Staff in Electrical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference book: Introduction to Electrical Engineering—Ward.

331. Alternating Currents. A. G. Ratz.

Courses 1, 2 and 9, II Year; 1 hr. lecture per week, both terms.

Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. H. A. Courtice.

Courses 3, 6, and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculations of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. H. F. Philp.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

Reference book: Electric and Magnetic Fields—Boast.

334. Electrical Laboratory.

Courses 3, 6, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

335. Electrical Problems.

Course 7, III Year; 2 hrs. per week, first term; 4 hrs. per week, second term.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair.

Course 7, III Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the application of electronics to electrical engineering.

Reference book: Electromic Engineering Principles—Ryder.

339. Direct Current Machines. G. F. Tracy, D. N. Cass-Beggs, R. Scott.

Course 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering. Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. G. F. Tracy and staff.

Courses 3 and 11, III Year; 2 hrs. lectures per week, first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. J. E. Reid, B. de F. Bayly.

Course 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, and other electrical equipment.

343. Electrical Design Laboratory. L. S. Lauchland.

Course 7, III Year; 4 hrs. laboratory per week, first term.

To accompany subject 342.

344. Electrical Laboratory.

Course 7, III Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together

with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. G. F. Tracy and staff.
Course 3, III Year; Course 11, IV Year; 2 hrs. lectures per week, first term.
Characteristics of alternating current machines and the various methods of control.

346. Electrical Laboratory.
Course 3, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, first term.
Course 11, IV Year; 3 hrs. laboratory per week, first term.
Experiments on alternating current circuits and machines.

348. Electrical Machinery. C. E. Doeringer.
Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.
Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory.
Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.
Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory.
Courses 1, 2, and 9, II Year; 3 hrs. laboratory per week, second term.
Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Circuit Analysis. V. G. Smith.
Course 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.
Course 5e, IV Year; 2 hrs. lectures per week, both terms.
Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.
Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid, G. Sinclair, L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, both terms.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are anlyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. D. N. Cass-Beggs, G. F. Tracy.

Course 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Electric Circuits. L. S. Lauchland.

Course 5, II Year; 2 hrs. lectures per week, both terms.

Principles of direct-current circuits including the more important methods of measuring resistance, potential difference, current, power and energy. Principles of alternating-current circuits together with methods of calculating single-phase and polyphase circuits, network theorems.

355. Electrical Laboratory.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week, second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electric Circuits Laboratory.

Course 5, II Year, 3 hrs. laboratory alternate weeks, both terms.

Laboratory exercises to accompany subject 354.

357. Engineering Electronics. D. N. Cass-Beggs.
Courses 5e and 7, IV Year; 2 hrs. lectures per week, first term 1 hr. lectures per week, second term.
Electronic devices, such as the thyratron, ignition and mercury arc rectifier, and their application to engineering problems.
Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory.
Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.
Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.
Course 7, IV Year; 2 hrs. per week, both terms.

360. Communications I. J. E. Reid, G. Sinclair.
Courses 5e, 5i, 5s, and 7, IV Year; 3 hrs. lectures per week, first term.
The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.
Reference book: Electron-Tube Circuits—Seely.

361. Communications Laboratory.
Courses 5e, 5i, 5s, and 7, IV Year; 3 yrs. laboratory per week, first term.
Experiments and problems to accompany subject 360.

362. Communications II. J. E. Reid, G. Sinclair.
Courses 5e and 7, IV Year; 3 hrs. lectures per week, second term.
A continuation of subject 360.

363. Communications Laboratory.
Courses 5e and 7, IV Year; 3 hrs. laboratory per week, second term.
Experiments and problems to accompany subject 362.

364. Operational Methods. V. G. Smith.
Courses 5e, 5i, and 5s, IV Year; 2 hrs. lectures per week, both terms.
A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Cicuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus —Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5e, 5g, and 5s, IV Year; 2 hrs. lectures per week, both terms.

A comparison of the classical, the rationalized C.G.S. and the M.K.S. systems of units is made, thereafter the M.K.S. rationalized system is used exclusively. Electrostatics is developed to the point where it is used to compute the capacities of engineering structures. Magnetostatics is mentioned briefly. The laws of electromagnetism are reviewed and Maxwell's equations developed. These are applied in a study of the reflection and refraction of plane waves, in an elementary study of rectangular wave guides and of the radiation from an antenna.

Reference books: Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague. Fundamentals of Electric Waves—Skilling. Wave Guides—Lamont.

366. Electronics. B. de F. Bayly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Basic theory of the behaviour of electrons in electric and magnetic fields, thermionic emission, vacuum-tube characteristics and applications, conduction through gases, gaseous-tube characteristics and applications.

Reference books: Applied Electronics—M.I.T. Staff.

367. Alternating-Current Circuits. G. F. Tracy and Staff.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Methods of treating alternating-current circuits, root-mean-square values, series circuits containing resistance, inductance and capacitance, parallel circuits, three-phase circuits.

368. Alternating-Current Circuit Laboratory.

Courses 3 and 11, II Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 367.

369. Alternating Current Machinery II. G. F. Tracy, D. N. Cass-Beggs.

Course 7, IV Year; 2 hrs. lectures per week, second term.

A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.
Courses 5e and 7, IV Year; 2 hrs. lectures per week, second term.
Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory.
Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises and problems to accompany subject 371.

373. Electrical Design. L. S. Lauchland.
Course 7, IV Year; 2 hrs. lectures per week, second term. A continuation of subject 342.

374. Electrical Design Laboratory.
Course 7, IV Year; 2 hrs. laboratory per week, second term.
Design projects and exercises to accompany subject 373.

375. Electrical Engineering. A. J. Kravetz.
Course 10, III Year; 2 hrs. lectures per week, both terms.
Principles of d-c and a-c circuits including the more important methods of measuring resistance, current, potential difference, power and energy; the principles of operation of d-c and a-c machinery; thermionic tube characteristics and applications.

376. Electrical Engineering Laboratory.
Course 10, III Year; 3 hrs. laboratory per week, both terms.
Laboratory exercises to accompany subject 375.

377. Electric Machines. G. F. Tracy.
Course 5e, III Year; Course 5t, IV Year; 2 hrs. lectures per week, both terms.
Operating characteristics, control, and applications of direct-current and alternating-current machines.

378. Electric Machines Laboratory.
Course 5e, III Year; Course 5t, IV Year; 3 hrs. laboratory per week, both terms.
Laboratory exercises to accompany subject 377.

379. Electronics Laboratory.
Course 5, III Year; 3 hrs. laboratory per week, second term.
Laboratory exercises to accompany subject 366.

GEOLOGICAL SCIENCES

380. Physical Geology. G. B. Langford.
Courses 2 and 9, I Year; 2 hrs. lecture per week, both terms.
An introduction to the study of geology and mineralogy.
Reference Books: Principles of Physical Geology—Holmes. Outlines of Historical Geology—Schuchert and Dunbar.

381. Physical Geology Laboratory. G. B. Langford.
Courses 2 and 9, I Year; 2 hrs. per week, both terms.
A laboratory course to accompany subject 380. Local field trips.

382. Engineering Geology. A. MacLean.
Courses 1 and 5g, III Year; 2 hr. lecture per week, both terms.
Structural, dynamic and economic geology, with special reference to engineering problems.

383. Engineering Geology Laboratory. G. B. Langford.
Courses 1 and 5g, III Year; 1 hr. per week, first term; 2 hrs. per week, second term.
Specimens, maps, and sections to accompany subject 382.

384. Glacial Geology. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.

385. Elementary Geochemistry. F. G. Smith.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Covering the periodic table, distribution of the elements, states of matter, phase diagrams, natural hydrothermal solutions, weathering, and geochemical cycles.

386. Mineralogy and Lithology. E. W. Nuffield.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. lecture per week, both terms.
A study of crystallography, descriptive and determinative mineralogy, and the common rocks.
Reference book: An Introduction to the Study of Minerals—Rogers.

387. Mineralogy and Lithology Laboratory. E. W. Nuffield.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. per week, both terms.
Practice in identifying minerals and rocks.

388. Advanced Mineralogy. E. W. Nuffield.
Course 9, IV Year; 2 hrs. per week, both terms.
Continuation of the mineralogy of subject 386.

390. Morphological Crystallography.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

391. Petrology. W. W. Moorhouse.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Microscopic character of the rock-forming minerals in thin sections, and description and classification of rocks.
Text book: Optical Mineralogy—Rogers and Kerr.

392. Petrography Laboratory. W. W. Moorhouse.
Course 9, III Year; 2 hrs. per week, both terms.
Microscopic petrography, to accompany subject 391.
Text books: As in subject 391.

393. Historical and Stratigraphical Geology.
Course 9, II Year; 2 hrs. lectures per week, both terms.
Study of the principles of stratigraphy and historical geology since Precambrian times.

394. Historical and Stratigraphical Geology Laboratory.
Course 9, II Year; 2 hrs. per week, both terms.
Laboratory work to illustrate subject 393.

395. Palaeontology. M. A. Fritz.
Course 9, III Year; 2 hrs. lectures per week, both terms.

396. Palaeontology Laboratory. M. A. Fritz.
Course 9, III Year; 2 hrs. per week, both terms.

397. Structural Geology. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Structures caused by the deformation of the earth's crust.
Text book: Structural Geology—Billings.

398. Structural Geology Laboratory. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 3 hrs. per week, both terms.
Work with geological maps of folded and faulted areas, structural sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 397.

399. Mineral Deposits. W. H. Gross.
Courses 2 and 9, III Year; Courses 5g and 8a, IV Year; 2 hrs. lectures per week, both terms.
The first term covers the metallic ore deposits and the second term the non-metallic deposits, including coal and petroleum.

400. Mineral Deposits Laboratory. W. H. Gross.
Course 9, III Year; 3 hrs. per week, both terms.

401. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

402. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. laboratory per week, second term.
Accompanying subject 401.

403. Precambrian Geology. W. W. Moorhouse.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Precambrian formations of Canada—their rocks, distribution, relationships and economic features.

404. Precambrian Geology Laboratory. W. W. Moorhouse.
Course 9, IV Year; 3 hrs. laboratory per week, second term.
To accompany subject 403.

405. Mining Geology. G. B. Langford.
Courses 2, 5g, IV Year; 2 hrs. lectures per week, second term.
Course 9, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
A course dealing with the application of geology to mining.
Reference book: Mining Geology—McKinstry.

406. Mining Geology Laboratory. G. B. Langford.
Course 9, IV Year; 3 hrs. per week, both terms.
A laboratory course to accompany subject 405.

407. Petroleum Geology. W. M. Tovell.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
The origin, nature, and occurrence of petroleum and natural gas deposits and the extraction of these substances from the earth.

408. Petroleum Geology Laboratory. W. M. Tovell.
Course 9, IV Year; 3 hrs. per week, second term.
Accompanying subject 407.

409. Geological Field Work. G. B. Langford.
Courses 2 and 9, III Year; given at the University Survey Camp preceding the opening of the first term. Students taking this course must supply themselves with a geological pick, hand lens, and engineer's 6″ pocket scale.
Reference book: Field Geology—Lahee.

410. Geological Field Trips (Historical Geology).
Course 9, II Year (1 day).
The Niagara Escarpment and the west end of Lake Ontario.

411. Geological Field Trips (Precambrian and Mineralogy).
Course 9, III Year. 2½ days.
Bancroft and Madoc Areas.

412. Geological Field Trips (Glacial Geology). A. MacLean.
Courses 2 and 9, IV Year. Three ½ day trips.
During October weekly trips will be made to points of interest near Toronto.

413. Geological Field Trips (Petroleum).
Course 9, IV Year. 2½ days.
Oil and gas fields in Chatham area.

414. Geological Field Trips (Economic and Mining).
Course 9, IV Year. Two trips, each ½ day.
Trip to gypsum mine and cement plant.

HEAT ENGINES

420. Elementary Heat Engines. F. G. Ewens, C. E. Olive, J. M. F. Vickers.
Course 3, II Year; 1 hr. lecture per week, both terms.
Course 11, II Year; 1 hr. lecture per week, both terms.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
Course 7, II Year; 1 hr. lecture per week, first term.
Course 10, II Year; 1 hr. lecture per week, first term.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut, P. B. Hughes, F. C. Hooper.
Course 3, III Year; 2 hrs. lectures per week, both terms.
Courses 5t and 10, III Year; 2 hrs. lectures per week, both terms.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, both terms.
Course 7, III Year; 2 hrs. lectures per week, both terms.
Course 11, III Year, 2 hrs. lectures per week, both terms.

For each group selected topics are arranged to suit the courses included in the group.

The application of the laws of thermodynamics to ideal processes and cycles using gases and vapours. The cycles used in practice for steam and internal combustion engines, compressors and refrigerating plants. Unavailable energy and entropy. Theoretical and practical efficiencies obtainable. Heat transfer and regeneration. Tables and charts for vapours used in engineering practice.

Reference book: Elementary Engineering Thermodynamics—Young and Young.

422. Heat Engineering. R. C. Wiren.
Course 3, III Year; 2 hrs. lectures per week, both terms.

Internal Combustion Engines. Types and operation; performance and testing; basic characteristics and principles of design; carburation; fuel injection; governing.

Steam Turbines. Types and basic characteristics; condensers and auxiliaries; cooling towers.

Steam Generators and Plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces, stokers, pulverised fuel equipment, economizers, air heaters, superheaters, etc.

Air Conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Reference books: Internal Combustion Engines—Polson. Maleev. Obert. Fraas. Steam Turbines—Church. Elementary Heat Power-Solberg, Cromer and Spalding. Heat Engines—Allen and Bursley. Steam Power Plants—Gaffert. Potter. MacNaughton. Air Conditioning—Mackey. Holmes. Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, W. A. Wallace, W. T. Thompson, F. C. Hooper.

Courses 3, 5t, and 10, III Year; 1 three-hour laboratory period per week, both terms.

Course 7, III Year; 1 three-hour laboratory period per week first term.

Course 11, III Year; 1 three-hour laboratory period per week, second term.

The laboratory work is designed to assist in clearer understanding of theory and practical applications, and consists of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

The work on Heat Engines deals with the setting of slide valves, measuring indicated and brake horse-power, the use of power plant instruments and auxiliaries, testing of air compressors, steam engines, steam turbines and internal combustion engines under various conditions, steam calorimetry and the solution of numerous practical problems.

The Fuel Testing includes analysis of fuels and products of combustion, knock rating of gasolines, fuel calorimetry, etc.

The work on Heat Transfer deals with temperature measurement, tests on insulation and heat exchangers of various kinds.

The work on air conditioning deals with the use of instruments and charts, air conditioning standards and the solution of practical problems.

424. Heat Power Engineering. R. C. Wiren.

Courses 3 and 5t, IV Year; 2 hrs. lectures per week, both terms.

A continuation of lecture course 421 consisting of a more advanced study as applied to power plants. Properties of pure substances. Analysis and applications of the First and Second Laws. Change of phase and equations of state. Thermodynamic functions and relations as applied to a perfect gas and working fluids used in power plants. Unavailable energy and entropy. Charts and diagrams

used in practice. Steam as a working fluid. Steam turbines. Power plant cycles including reciprocating engines and turbines. Cycles for high pressures and temperatures. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies.

Reference books: Heat and Thermodynamics—Zemansky. Engineering Thermodynamics—Obert. Everett. Keenan. Ebaugh. Hawkins. Steam Power Plants—Gaffert. Potter. MacNaughton. Steam Turbines—Church. Salisbury.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3 and 5t, IV Year; 1 hr. lecture per week, both terms.

The various types of internal combustion engine and their respective applications. The different cycles of operation and the avoidable and unavoidable losses. The admission, compression, combustion, expansion and exhaust operations, the factors that influence them and their application to the engine and turbine. The cooling system and its effect on thermal and mechanical conditions.

426. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper.

Course 3, IV Year; 5 hrs. laboratory work per week, both terms.

Course 5t, IV Year; 6 hrs. laboratory work per week, both terms.

A continuation and extension of the work covered in the III Year laboratory subjects consisting of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

In the Heat Engine laboratory complete tests are made of various engines such as simple, compound and uniflow steam engines, impulse and reaction type steam turbines, steam injectors, gas, oil and gasoline engines. In each case an analysis is made of the thermal cycle involved, a complete set of experiments is performed and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Problems involving variable specific heat are studied.

In the Fuel Testing laboratory the octane rating of gasoline samples is determined by A.S.T.M. methods and fuel injection spray characteristics are studied with special test equipment.

In the Heat Transfer laboratory tests are made on heat exchangers.

In the Air Conditioning and Refrigeration laboratory tests are performed on complete air conditioning systems, and complete refrigerating plants.

427. Theory of Heat Engines. R. C. Wiren.

Course 1, III Year; Course 2, IV Year; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

Reference books: Elementary Engineering Thermodynamics—Young and Young. Engineering Thermodynamics—Ebaugh. Theory and Practice of Heat Engines—Faires.

428. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, D. G. Huber, H. M. McFarlane.

Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Courses 2 and 8a, III Year; Course 8a, IV Year (1951-52 only); 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes and open channels, with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, D. G. Huber, H. M. McFarlane.

Courses 1, 3, 7, and 11, III Year; one 3-hr. laboratory period per week, second term.

Course 6, III Year; one 3-hr. laboratory period per week, first term.

Course 2, III Year; six 3-hr. laboratory periods, first term.

Course 8a, III Year; Course 8a, IV Year (1951-52 only); one 3-hr. laboratory period per week, first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. The lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc. are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3- and 2-hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomena, fans and ductwork, and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps. Turbines and water power developments.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 1, IV Year; one 3-hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. L. E. Jones, H. M. McFarlane.

Courses 1, 3, 6, 7, and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure-density-height relationships. Measurement of pressure intensity. Fluid thrust on submerged surfaces. Buoyancy and flotation.

448. Mechanical and Thermal Measurements. L. E. Jones.

Courses 2, 3, 6, 7, 9, and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities, and means of measuring them. Dimensions, units, standards, length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 2 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analysing technical data; elements of curve-fitting and statistical treatment.

450. Hydraulics. D. G. Huber.

Course 5t, III Year; 1 hr. lecture per week, both terms.

A course emphasizing the fundamentals of fluid flow in pipes with special reference to refrigeration problems and including discussion of pumps.

Reference books: Elementary Fluid Mechanics—Vennard. Centrifugal Pumps and Blowers—Church. Refrigerating Data Book.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. L. E. Jones.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed

hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

MACHINERY

461. Mechanical Engineering. J. W. Church.

Course 3, II Year; 2 hrs. lectures per week, both terms.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

462. Elementary Machine Design. W. G. McIntosh, R. T. Waines.

Courses 6 and 7, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machining, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design (involving material applications and calculation of stresses) and selection of various machine elements with particular application to power transmission (belting, shafting and gearing), fastening screws, power screws and wire rope.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory will illustrate the lecture subject.

465. Theory of Machines A. I. W. Smith.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical application. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination

of efficiency. The plotting and use of crank effort and torque diagrams.

Text book: Mechanism—Prageman.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Text book: Vibration; Mechanical Vibrations—Thomson.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, III Year; an average of 7 hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Course II, III Year; 3 hrs. laboratory per week, both terms.

Design laboratory work will be taken by students in all courses listed above. This will involve the design of machine elements with the object of illustrating the work covered in the lecture subjects in Machine Design. Sketching and drafting will be given with a view to developing the student's judgment and sense of proportion in design and the application of drafting room standards.

Mechanics of Machinery laboratory work will be taken by Course 3 only. This will include the analytical and graphical solution of problems dealing with inertia loads and stresses and the determination of speed fluctuation.

Mechanical laboratory work will be taken by Courses 3 and 10. This will include selected experiments in speed measurement, oil testing, balancing, testing of power drives, etc.

Machine and Welding Shops laboratory work will be taken by all groups. This will take the form of demonstrations of equipment in

these shops with a view to assisting students in the visualization of manufacturing methods employed for parts being designed.

469. Machine Design. R. T. Waines.

Courses 2, 6, 8, and 8a, IV Year; 1 hr. lecture per week, both terms.

The design and selection of machinery and equipment met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6, 8, and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. W. E. Morley.

Course 5, III Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. E. Morley.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

This is a continuation of Subjects 467 and 466. It will involve the design of various machine elements and equipment including machine frames, hooks, hoisting equipment, crankshafts, gears (helical, herringbone, bevel, screw, and worm), springs, clutches, brakes, thin and thick wall vessels.

An introduction will be given to the study of vibration problems encountered in high speed engines and machines.

Text book: Design of Machine Elements—Faires.

474. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines, W. E. Morley.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Advanced laboratory work involves both analysis and design of machine elements, machine units, and complete machines. The selection of problems is made with a view to giving the student as broad a coverage as possible and providing experience in combining of elements to form a machine of smooth and harmonious design. Some of this work will involve special shafting problems including graphical solutions, critical speeds, and multiple supports.

Work will be given in the Mechanical Laboratory on gauging and fine measurements, experimental stress analysis, vibration, and bearing testing.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Spotts.

476. Manufacturing Processes. J. W. Church.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

Text book: Manufacturing Processes—Begeman.

Reference books: Handbook on Designing for Quantity Production—Chase. Casting and Forming Processes in Manufacturing—Campbell. Machine Tools for Engineers—Hine. Manufacturing Processes (2 vols.)—Rusinoff.

477. Manufacturing Processes Laboratory. J. W. Church.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

478. Machine Design. W. E. Morley.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

A series of lectures intended to supplement subject 471 of the Third Year, while co-ordinating with the Fourth Year thermodynamic subjects, by presenting the overall approach employed in the design of simple power units.

MATHEMATICS

490. Calculus. S. Beatty, I. R. Pounder, R. G. Stanton, J. E. LeBel, J. G. Semple.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 2 hrs. lectures per week, both terms.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems con-

cerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

491. Calculus. J. D. Burk, G. de B. Robinson, G. E. N. Fox, H. S. Heaps, G. M. Peterson.

Courses 1, 3, 6, 7, 8, 8a, and 11, II Year; 2 hrs. lectures per week, both terms.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289.

492. Analytical Geometry. S. Beatty, I. R. Pounder, R. G. Stanton, J. E. LeBel, J. G. Semple.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate the general methods of analytical geometry. Introduction to Analytical Geometry of Three Dimensions. In addition, problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

494. Least Squares. O. J. Marshall, H. L. Macklin.

Course 1, II Year; 1 hr. lecture and 2 hrs. laboratory per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulæ.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes.

495. Mathematical Problems. W. J. Webber, D. A. F. Robinson, W. T. Tutte, G. Feldman.

Courses 5 and 10, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. W. J. R. Crosby.

Courses 5 and 10, I Year; $3\frac{1}{2}$ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the

circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books: Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. W. J. R. Crosby.

Courses 5 and 10, I Year; $1\frac{1}{2}$ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. G. Feldman.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger, J. G. Semple.

Courses 1 and 8, III Year; 1 hr. lecture per week, both terms.

First order equations solvable by quadratures, linear equations of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorf, and Pohlhausen.

509. Differential Equations. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. B. A. Griffith.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. J. Coleman.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

METALLURGY

530. Metallurgy. L. M. Pidgeon, B. Chalmers.

Course 8, II Year; 1 hr. lecture per week, both terms.

Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations, and principles of physical metallurgy.

531. Metallurgical Problems Laboratory. H. U. Ross.
Course 8, III Year; 2 hrs. laboratory per week, both terms.
Problems in physical chemistry and thermodynamics as applied to metallurgical reactions.

532. Physical Metallurgy I. B. Chalmers, E. Thall.
Course 11, II Year; Course 3, III Year; 1 hr. lecture per week, both terms.
A general course in Physical Metallurgy, dealing with the structure of metals and alloys, with special reference to the ferrous and non-ferrous alloys of practical importance. The influence of mechanical deformation, heat treatment and composition on the structure is considered, and the relation between the structure and the mechanical properties is examined.

534. Principles of Extractive Metallurgy. L. M. Pidgeon.
Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A general discussion of the fundamental principles of extractive metallurgy with reference to the production of the more important metals.

535. Principles of Extractive Metallurgy Laboratory. H. U. Ross.
Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.
Experiments in pyrometry, roasting, smelting, leaching, retorting and refining designed to illustrate the principles underlying these operations. Spectrographic analysis of metals is included.

536. Principles of Physical Metallurgy. B. Chalmers.
Course 8, III Year; 2 hrs. lectures per week, both terms.
One hour lecture per week in first term consists of a series of lectures on the structure of solids, with particular reference to x-ray methods of investigation.

537. Physical Metallurgy Laboratory. B. Chalmers, E. Thall.
Course 8, III Year; 3 hrs. laboratory per week, both terms.
Practical work relating to subject 536.

538. Metallurgy. L. M. Pidgeon.
Course 2, IV Year; 1 hr. lecture per week, both terms.
The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes.

539. Metallurgy Laboratory. H. U. Ross.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgical Problems Laboratory. H. U. Ross.
Course 8, IV Year; 2 hrs. laboratory per week, both terms.
Problems dealing with subject matter in subjects 542 and 552.

541. Metallurgy Laboratory. H. U. Ross.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term.
A continuation of subject 535.

542. Non-Ferrous Production Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Extractive metallurgy of the non-ferrous metals, including electrometallurgy.

543. Physical Metallurgy. B. Chalmers.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536.

544. Physical Metallurgy Laboratory. B. Chalmers, E. Thall.
Course 8, IV Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practical work relating to subject 543.

546. Physical Metallurgy. B. Chalmers, E. Thall.
Course 1, III Year; 2 hrs. lectures per week, first term.
A short course on the influence of heat and mechanical treatment on the structure and properties of steels and the more important non-ferrous alloy.

547. Physical Metallurgy 2. B. Chalmers, E. Thall.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 532.

548. Physical Metallurgy Laboratory. B. Chalmers, E. Thall.
Courses 3 and 11, IV Year, 1½ hrs. laboratory per week, second term.
A practical course illustrating the principles dealt with in subjects 532 and 547.

549. Physical Metallurgy. B. Chalmers, E. Thall.
Course 5, 7, and 8a, III Year; Courses 2, 9, and 10, IV Year; 1 hr. lecture per week, both terms.
A short course in Physical Metallurgy; stucture of metals and alloys; effects of mechanical distortion and heat treatment on structure; relation between structure and mechanical properties; and properties of some steels and non-ferrous alloys.

550. Metallurgical Theory. W. C. Macdonald.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

552. Ferrous Production Metallurgy. H. U. Ross.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Production metallurgy of iron and steel.

CERAMICS

560. Ceramic Minerals and Calculations. P. M. Corbett, B. Chalmers.

Course 8a, III Year; 4 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.

Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term. One hour per week first term to be devoted to a joint lecture with subject 536 on structure of solids.

561. Heavy Clay Products Laboratory. P. M. Corbett.

Course 8a, III Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. P. M. Corbett.

Course 8a, III Year; 2 hrs. lectures per week, second term.

The composition of clear and coloured glazes.

565. Refractories and Ceramic Bodies. P. M. Corbett.

Course 8a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. P. M. Corbett.

Course 8a, IV Year; 1 hr. lecture per week, both terms.

Composition and manufacture of glass and iron enamels.

568. Whitewares and Enamels Laboratory. P. M. Corbett.

Course 8a, IV Year; 6 hrs. laboratory per week, both terms.

Advanced work on the compounding and testing of non-metallic mineral products.

MODERN LANGUAGES

610. English. W. J. T. Wright.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 1 hr. lecture per week, both terms.

The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading

613. German. T. Hedman.

Course 6, I Year; 2 hrs. lectures per week, both terms.

614. German. T. Hedman.

Course 6, II Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German.

PHYSICAL EDUCATION

640. Physical Education.

All courses, I and II Years.

The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. G. D. Scott, J. N. P. Hume.

Courses 5, 8, 8a, and 10, I Year; 4 hrs. lectures per week, both terms.

In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.

Text books: Physics, Vol. 1—Shortley and Williams. Principles of Physics, Vol. 1—Sears. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. G. D. Scott, J. N. P. Hume.

Courses 5, 8, 8a, and 10, I Year; 3 hrs. laboratory per week, both terms.

Supplementary to subject 650.

652. Elementary Magnetism and Electricity. D. S. Ainslie.

Courses 5, 8, 8a, and 10, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.

Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford, D. S. Ainslie.

Courses 5, 8, 8a, and 10, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics. D. S. Ainslie.

Courses 5, 8, 8a, and 10, II Year; 1 hr. lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655. Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5, II Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Courses 8, 8a, and 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Physics of Solids and Fluids. C. Barnes.

Course 5, III Year; 1 hr. lecture per week, both terms.

Gravitational potential and Laplace's equation. Vibration theory –damped motion, coupled oscillations, etc. Elasticity. Introduction to fluid motion and heat conduction. Differential equations of quantum mechanics.

657. Thermodynamics and Kinetic Theory. D. G. Ivey.

Course 5, III Year; 3 hrs. lectures per week, both terms.

Temperature scales, thermometry, calorimetry. First and Second laws, Entropy and Kelvin Thermodynamic Scale, equations of state, the Virial expansion. Ideal and van der Waal's gases. Specific heats. Thermodynamic functions. Joule-Thomson effect. Radiation and pyrometry up to Wien and Planck Laws. Distribution of velocities. Transport Phenomena. Borwnian motion.

659. Physical Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term.

Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, H. J. C. Ireton, H. L. Welsh.

Courses 5e, 5i, 5g, and 5s, IV Year; 3 hrs. lectures per week, both terms.

Introduction to quantum theory, atomic, molecular and nuclear physics.

665. Physical Laboratory. H. J. C. Ireton.
Course 5s, IV Year; 9 hrs. laboratory per week, both terms.
Accompanying the lecture subjects 663, 666, and 669.

666. Advanced Optics. M. F. Crawford.
Course 5s, IV Year; 2 hrs. lectures per week, both terms.
Diffraction, interference, and polarisation.
Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams. Cours d'Optique—Bruhat.

669. Analysis of Materials by Spectrographic and X-Ray Methods. H. J. C. Ireton.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.
Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. G. D. Garland, D. V. Anderson.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, thermometric, and radioactive methods.
Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. G. D. Garland, D. V. Anderson.
Course 9, IV Year; 1 hr. lecture per week, both terms.
Introduction to physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.
Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. A. A. Brant, G. D. Garland.
Course 5g, IV Year; 6 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 670.

673. Geophysics. A. A. Brant, G. D. Garland.
Course 9, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.
Course 5i, IV Year; 3 hrs. laboratory per week, both terms.
Accompanying subject 663.

675. Physics of the Earth. J. T. Wilson, G. D. Garland.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

PRACTICAL EXPERIENCE

690 Practical Experience.
Course 1.
Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.
Course 2.
Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.
Course 3.
Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

694. Practical Experience.

Course 6.

Every student in Chemical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 800 hours' experience in work connectedwith engineering practice of a nature acceptable to the department.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit before graduation, evidence of having had at least 1200 hours of practical engineering experience satisfactory to the department. Certificate forms may be obtained from the departmental office and the completed certificates should be returned to the department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development, underground work or service on geological field parties, and at least half of the time should be spent underground. Forms to be used in submitting experience record are available in the Department of Geological Sciences office.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, H. L. Macklin, B. J. Haynes, W. H. Carr.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the tape, the transit, and the level, and computation of corrections, azimuths, bearings, latitudes and departures, co-ordinates and areas.

Text book: Printed notes on Elementary Surveying—Staff in Surveying.

Reference books: Surveying—Philip Kissam. Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed.

712. Field Work. W. M. Treadgold, O. J. Marshall, H. L. Macklin, B. J. Haynes, W. H. Carr.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; keeping of field notes; the use of the transit in surveying closed figures and traverse lines; plotting by co-ordinates; computing of areas; instrumental work with the level and calculating the volume of excavations.

714. Surveying. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, compound and spiral curves as applied to highway and railroad surveying. Main features of mine and hydrographic surveying.

Text books: Printed notes—Staff in Surveying. Railroad Curves and Earthwork—Allen. Route Surveys—Skelton.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, O. J. Marshall, B. J. Haynes, W. H. Carr.

Course 1, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and curves.

717. Field Work. H. L. Macklin.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling, curves and topography.

718. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 2 hrs. lectures per week, second term.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

720. Survey Camp. W. M. Treadgold, O. J. Marshall, J. W. Melson, T. L. Rowe, H. L. Macklin, B. J. Haynes, W. H. Carr, G. B. Langford, W. W. Moorhouse.

Courses 1, 2, and 9, III Year.

Course 1 (part)...............Aug. 20 to Sept. 22—Dorset.

Courses 1 (part), 2, and 9......Aug. 20 to Sept. 22—Gull Lake.

Course 1:

(*a*) Secondary Triangulation and Base Line Measurements.

(*b*) Highway and Railway Location.

(*c*) Cross Sectioning and Computation of Earthwork.

(*d*) Stadia and Plane Table Topography.

(*e*) Observations for Time, Azimuth, and Latitude.

Courses 2 and 9:

(*a*) Stadia and Plane Table Topography.

(*b*) Mine Surveying, using overhead stations.

(*c*) Shaft plumbing and use of Auxiliary Telescope.

(*d*) Geological Surveying and mapping.

Students in Courses 1, 2, and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year; 2 hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instructions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis Seminar.

Course 5, IV Year.

Each student in the Fourth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training for those fields.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the

Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, first term.

Each student must collect suites of rocks and minerals or fossils during the summer vacation preceding the IV Year. This material must be identified and described during the first term, and the report covering this work must be submitted by January 31st of the IV Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course 11, IV Year.

Each student in the Fourth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work in each subject is 50% and a student must obtain a weighted average of 60% in order to pass in the work of the year. He shall be required to pass a supplemental examination in each subject in which he obtains less than 50%. Subjects will be weighted according to the number of hours devoted to them, the hours assigned to laboratory subjects being given one half the weight of those in lecture subjects.

5. Honours and scholarships will be awarded upon the basis of the weighted average.

6. Honours will be awarded to a student, who at the Annual Examinations passes in all written and laboratory subjects and who also obtains a weighted average of 75% on the work of the year.

7. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

8. A student who fails in the work of any year, provided he is otherwise eligible, will be permitted to register provisionally for the purpose of repeating the year.

9. If the performance of a student repeating the First Year is unsatisfactory during the first term, as determined by laboratory marks and written examinations, he may be required to withdraw.

10. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

11. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they failed before presenting themselves a second time for examination.

12. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

13. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

14. A student who has failed to complete satisfactorily the course in Physical Education prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Education prescribed for the Second Year will not be permitted to register in the Fourth Year.

15. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 27th day of August, 1951. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by the order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. MEDALS, PRIZES, SCHOLARSHIPS, BURSARIES AND FELLOWSHIPS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

In order to be eligible for a medal, prize, scholarship, bursary, fellow ship or other awards granted solely upon standing obtained at an annual or special examination or upon an essay, or term work, or other academic rating, a candidate must obtain honours at such annual or special examination or upon such essay, term work, or other academic rating unless the statute respecting the award or medal specifies that standing lower than honours may be accepted.

When an award or medal is granted upon standing obtained on part of the work of any academic year the candidate must obtain standing but need not obtain honours in the work of the academic year as a whole, provided he obtains honours in the part concerned, unless the statute respecting the award or medal specifies otherwise.

No medal, prize, scholarship, bursary, fellowship or other award will be granted to a candidate who is conditioned in any subject at an annual examination or in Physical Education unless the statute respecting the award or medal specifies otherwise.

A candidate will not be permitted to receive more than one award in a session unless the statute establishing each of the awards concerned or the Calendar specifies otherwise. Only one of those marked by an asterisk may be held in any one year. A candidate who would, but for this provision, have received more than one award may have his name so published in the class lists.

A candidate who has spent two sessions in any year of an undergraduate course is not eligible to compete for any award at the annual examinations of that year.

Medals, after they have been suitably engraved, will be given without delay to the winners or forwarded to them by registered mail.

Awards granted to members of graduating classes other than awards for graduate study and research, will be paid in one instalment as soon as possible after the granting of the awards.

All other awards will be paid (i) if of the value of $50 or less, in one instalment on November 20 and (ii) if of the value of more than $50 in two equal instalments, the first on November 20 and the second on February 20, in the session following the granting of the awards provided that no payment is made to a candidate (*a*) who is not in regular attendance upon lectures and laboratory classes in the Faculty, or if the Calendar so specifies, in the course in which the award is established or granted (*b*) who does not present at the Chief Accountant's Office before each payment a certificate of attendance upon lecture and laboratory classes signed by two senior members of the staff.

The Senate may, on the recommendation of the Faculty, permit a candidate to whom an award has been granted to postpone attendance upon lectures and laboratory classes for one year. Further postponement may be permitted on application.

Name	Amount	Application required	Available only to a limited group or single course	See page
Available to Students Entering the First Year				
Applied Science Bursaries.....	$2000	Yes	No	142
Hagarty Memorial Scholarship	$60	Yes	Yes	142
U.T.S. Engineering Scholarship	$250	Yes	Yes	143
The Leonard Foundation Scholarships..............	—	Yes	Yes	143
The Robert Simpson Company Scholarship................	$100	Yes	Yes	143
O.H.A. War Memorial Scholarship...............	$200	Yes	Yes	144
Engineering Alumni Admission Scholarship...............	$300	Yes	No	144
Students' Administrative Council Admission Scholarship...	$350	Yes	Yes	144

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	145
*Baptie Scholarship..........	—	No	Yes	145
MacLennan-MacLeod Memorial Prize..............	—	No	No	145
*Ransom Scholarship in Chemical Engineering...........	$150	No	Yes	146
T. H. Bickle Prize...........	$30	No	Yes	146
*John M. Empey Scholarship..	$100	No	No	147
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics.......	$60	No	Yes	147
*Wallberg Undergraduate Scholarships..............	$600	No	No	147
*Association of Professional Engineers of the Prov. of Ontario Scholarships.......	$225	No	Yes	150
Hugh Gall Award...........	$100	Yes	No	147
University Naval Training Division Bursaries.........	$100	Yes	Yes	148
S. Ubukata Fund...........	—	Yes	Yes	149
University of Toronto General Bursaries................	—	Yes	No	164
Dominion-Provincial Student-Bursaries................	—	Yes	No	164
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship..........	£400	Yes	No	157
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	145
*Harvey Aggett Memorial Scholarship..............	$75	No	No	149
J. A. Findlay Scholarship.....	—	No	Yes	149
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$225	No	Yes	150
T. H. Bickle Prize...........	$30	No	Yes	146

Name	Amount	Application required	Available only to a limited group or single course	See page
Edith Tyrrell Memorial Bursary..................	$300	Yes	Yes	150
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships..............	—	No	Yes	150
*John M. Empey Scholarship..	$100	No	No	147
W. G. Millar Memorial Scholarship...............	$250	Yes	Yes	151
*Wallberg Undergraduate Scholarships..............	$300	No	No	147
Ardagh Prize................	$50	No	Yes	152
James L. Morris Memorial Prize	$60	No	Yes	152
University of Toronto General Bursaries.................	—	Yes	No	164
Dominion-Provincial Student-Aid Bursaries.............	—	Yes	No	164
Scottish Rite Masons Bursary.	$100	Yes	Yes	148
Eastern Steel Products Limited Scholarship...............	$350	Yes	Yes	152
Spruce Falls Power and Paper Co. Limited Scholarships..	$500	No	No	162
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship..........	£400	Yes	No	157
*Boiler Inspection and Insurance Company Scholarship......	$150	No	Yes	153
University Alumni Federation War Memorial Scholarships.	$250	Yes	No	155
*Jenkins Scholarship in Engineering...............	$200	No	No	153
Heating and Ventilating Engineers Prize................	$25	No	No	153
E.I.C. Prize.................	$25	No	Yes	153
Engineering Society Semi-Centennial Award..........	$75	No	No	154
J. A. Findlay Scholarship.....	—	No	Yes	149
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$225	No	Yes	159

Name	Amount	Application required	Available only to a limited group or single course	See page
T. H. Bickle Prize	$30	No	Yes	146
Edith Tyrrell Memorial Bursary	$300	Yes	Yes	150
Archie B. Crealock Memorial Prize	$25	No	Yes	154
*John M. Empey Scholarship	$100	No	No	147
Hudson Bay Mining and Smelting Company Limited Scholarships	$800	Yes	Yes	155
*Wallberg Undergraduate Scholarships	$300	No	No	147
*Algoma Ore Properties Limited Undergraduate Scholarships.	$600	No	Yes	148
Chemical Institute of Canada Prize	$25	No	Yes	155
Kennecott Copper Corporation Scholarship	$1000	No	Yes	155
RCE Memorial Scholarship	$125	Yes	Yes	156
Geo. W. Crothers Limited Scholarship	$250	Yes	No	154
Spruce Falls Power and Paper Co. Limited Scholarships	$500	No	No	162
University of Toronto General Bursaries	—	Yes	No	164
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	164
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR	—			
B.A.A.S. Medal		No	No	155
Heating and Ventilating Engineers Prize	$25	No	No	153
INCO. Scholarship	$500	Yes	Yes	156
"Second Mile Engineer" Award	$100	No	Yes	156
Henry G. Acres Medal	—	No	Yes	157
Massey-Harris Co. Ltd. Scholarships	$500	Yes	Yes	157
Geo. W. Crothers Limited Scholarship	$250	Yes	No	154
Ontario Section, American Society for Metals Prize	$50	No	Yes	155

Name	Amount	Application required	Available only to a limited group or single course	See page
University of Toronto General Bursaries	—	Yes	No	164
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	164
Available to Graduates				
Rhodes Scholarship	£400	Yes	No	157
1851 Exhibition Science Research Scholarships	£275	Yes	Yes	168
McCharles Prize	$1000	No	No	169
Nipissing Mining Research Fellowships	$600	Yes	No	160
H. W. Price Research Fellowship in Electrical Engineering	—	Yes	Yes	160
C.I.L. Fellowship in Chemistry	$750	Yes	Yes	160
T. A. Russell Memorial Research Fellowship	$1000	Yes	Yes	161
Consolidated Mining and Smelting Company Fellowship	$1000	Yes	No	161
Canadian Lumbermen's Association Timber Research Fellowship	$1000	Yes	No	161
Imperial Oil Graduate Research Fellowships	$4000	Yes	Yes	162
Wallberg Research Fellowships	$3000	Yes	No	162
Spruce Falls Power and Paper Company Limited Fellowships	$1000	Yes	No	162
Athlone Fellowships	—	Yes	No	162
1940 Toronto Fund	—	Yes	No	163
Raymond Priestley Fellowship	£450	Yes	No	163
Royal Institution of Great Britain Science Research Scholarships	£350	Yes	No	164

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

In those cases where the amount of the award is not payable from income earned on an endowed fund, payment will be dependent on the receipt of the amount of the annual award from the donor.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $200, will be awarded in 1951 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1951. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship

was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School, the Kapuskasing High School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute and Vocational School, from whom further information may be obtained regarding conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidate shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidate shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities

of North Bay, Sudbury, Sault Ste. Marie, Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, in the School of Architecture, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent. at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Five scholarships and awards, each of the value of $200.00 will be granted in 1951-52 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of financial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first

Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards listed in the Calendar with an asterisk. The awards were first made on the result of the annual examination of 1947.

HUGH GALL AWARD

The Hugh Gall Award, of the annual value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946 for a five year period and, through the generosity of Mrs. Hugh Gall extended for a further three year period. It is awarded

to a student, who, having completed his First Year with a general average of at least 66% without conditions, has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session. A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

THE SCOTTISH RITE MASONS' BURSARY

The Scottish Rite Masons' Bursary, the gift of the Scottish Rite Masons of Toronto, of the value of $100. is awarded to a student enrolled in the Second Year who is a member of the Masonic Order, or a son, brother, nephew, daughter, sister or niece of a member of the Masonic Order. Consideration will be given to financial need and academic standing. Evidence of connection with the Masonic Order and information regarding financial need must be given with the application which must be submitted to the Secretary of the Faculty.

ALGOMA ORE PROPERTIES LIMITED UNDERGRADUATE SCHOLARSHIPS

Through the generosity of Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, a number of Scholarships are available to students in Mining Engineering, Metallurgical Engineering, and Mining Geology, each of a value of $600.00. On the results of the annual examinations for the Session indicated below, the following scholarship will be awarded:

Session 1951-52

III Year—One Scholarship of Six Hundred Dollars.

It is the intention that a student having once won a scholarship on the results of the Annual Examinations should continue to hold it, provided he obtains Honours in his work in subsequent years.

The holders of any of these scholarships may not hold other scholarships in the same session.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering:—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

EDITH TYRRELL MEMORIAL BURSARY

The Women's Association of the Mining Industry of Canada has presented this Bursary, having the value of Three Hundred Dollars, annually, commencing in 1939, and named in memory of their founder and first president, Mrs. Edith Tyrrell. A medal donated by Dr. Tyrrell accompanies the Bursary. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Department of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in

Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endownment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course of Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00 is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examination of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris, C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income from $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the Examinations of the Second Year.

EASTERN STEEL PRODUCTS LIMITED SCHOLARSHIP

The Eastern Steel Products Limited Scholarship of an annual value of $350.00 has been established in the course in Mechanical Engineering for a period of five years.

The Scholarship will be awarded to a student entering the Third Year in Mechanical Engineering who:

(*a*) was registered in the course in Mechanical Engineering in this Faculty in his First and Second Years.

(*b*) obtained Honours in the work of the First and also of the Second Year.

(*c*) gives evidence not only of mental capacity but who also shows leadership ability, and gives promise of becoming a worth while influence in affairs of the profession and the community.

Consideration is given to financial need.

Application must be made to the Secretary of the Faculty not later than March 15.

The first award was made at the Annual Examinations of 1948.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Chief Accountant to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five

Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

GEO. W. CROTHERS LIMITED SCHOLARSHIP

Geo. W. Crothers Limited have presented a scholarship of an annual value of $250.00, commencing 1951-52.

The award will be made on the recommendation of a Committee of Award consisting of the Dean of the Faculty, two representatives of the Faculty Council and a representative of the donor on the following basis:

(*a*) The award is open to students registered in the Third or Fourth Years in this Faculty.

(*b*) Consideration will be given to academic achievement, financial need, extra-curricular activities and such other factors as may be appropriate.

(*c*) The scholarship is tenable with other awards.

(*d*) Application must be made to the Secretary of the Faculty not later than 1st November.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Course in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

KENNECOTT COPPER CORPORATION SCHOLARSHIP

The Kennecott Copper Corporation offers a scholarship of a value of $1000.00 annually to a student who has completed three years of the course in Mining Engineering or, in an exceptional case, to a graduate student proceeding to the Degree of Master of Applied Science in Mining Engineering. The award will be made on the following basis.

(*a*) proficiency in engineering studies.
(*b*) leadership, willingness, co-operativeness, initiative and ambition.
(*c*) ability to direct and stimulate others and to command their respect.
(*d*) good health and physique.

The first award was available in 1948.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

A gift of books accompanies the medal.

ONTARIO CHAPTER, AMERICAN SOCIETY FOR METALS PRIZE

The Ontario Chapter, American Society for Metals offers a prize of $50.00 to a student registered in the graduating class in Metallurgical Engineering. The award is made annually, commencing 1951, on the recommendation of the staff in the Department of Metallurgical Engineering, primarily on the basis of a Thesis on either physical or extractive metallurgy. The prize may be held along with any other award.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgy Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

R.C.E. MEMORIAL SCHOLARSHIP

The Memorial Fund Committee of the Royal Canadian Engineers has established the R.C.E. Memorial Scholarship of a value of One Hundred and Twenty-five Dollars, open to students who have successfully completed their second to last year in the Faculty of Applied Science and Engineering or the School of Architecture. A candidate must be a member in good standing of the Canadian Officers' Training Corps and have successfully completed one summer season's training. Selection is made on the basis of academic standing and of qualities of leadership.

Application forms may be obtained at the C.O.T.C. Orderly Room, 119 St. George St.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special enphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

THE MASSEY-HARRIS COMPANY LIMITED SCHOLARSHIPS

The Massey-Harris Company Limited has made available two Scholarships of a value of $250.00 each to students registered in the Fourth Year in Mechanical Engineering or Engineering and Business for the Session 1951-52.

In making the award consideration will be given to academic achievement, financial need, extracurricular activities and such other factors as may be considered appropriate. Application should be made to the Secretary of the Faculty not later than 15th October.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power developments at Shipshaw on the Saguenay River, which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer for award in the Province of Ontario two out of ten of the Rhodes Scholarships for Canadians, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year given conditionally at Oxford or elsewhere abroad may be authorized in proper cases.

Each candidate must be a British subject with at least five years domicile in Canada and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year *for* which he

is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

A candidate may apply either for the province in which he has his private home or residence, or for the province in which he has taken his university course.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., K.C., 5 Rosedale Road, Toronto 5, General Secretary for the Rhodes Scholarships in Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey or the appropriate provincial secretary on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the

candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be ineligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Dean MacFarlane, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

McCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award.

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time as recommended by the School of Engineering Research, to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $1,000.00 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $1000 for a research in some field of pure or applied science. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four Graduate Research Fellowships now having a potential value of $3,750.00 each ($1,250.00 a year payable in Canadian funds for a maximum of three years). The fellowships are open to graduates of any approved University in Canada and are offered for graduate study leading to a Master's or Doctor's degree in the fields of Chemistry and/or Engineering (two fellowships), Geology (one fellowship), and Economics or Industrial Relations

(one fellowship). Nomination of students for the fellowships is made by the University—such nominations to be received by Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st of each year. Nomination forms and information as to the terms of the fellowships are obtainable at the Registrar's Office.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships of the value of $1,500 each are open to graduates of any recognized university who propose to pursue advanced study and research in any branch of Engineering in the University of Toronto.

Forms of application may be obtained from the Secretary of the School of Graduate Studies. These should be returned together with a transcript of academic record and an outline of the proposed study and research not later than March 1st.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, SCHOLARSHIPS AND FELLOWSHIPS

The Spruce Falls Power and Paper Company Limited has established the Arthur Hays Sulzberger Fellowship for the encouragement of research in the Faculty, of an annual value of $1,000.00. It is open to graduates of the University of Toronto or of other recognized universities, but is restricted to Canadian Citizens. Application should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

The Company has also donated four scholarships of $250.00 each, two in the Second Year known as the Egerton S. Noble Scholarships and two in the Third Year known as the Charles H. Sage Scholarships. They are awarded on the results of the Annual Examinations to the students who stand first and second at the Annual Examinations of their respective years and are open to students in all courses. The first awards were made on the results of the examination in 1951, to be held for the session 1951-52.

THE ATHLONE FELLOWSHIPS

His Majesty's Government in the United Kingdom have established a number of fellowships to be awarded annually to enable Canadian engineering graduates to take postgraduate training in the United Kingdom. These became available in 1951 when five fellowships were open to graduates of the University of Toronto immediately after graduation. Additional fellowships are for award to graduates who have already spent some time in industry. The fellowships cover costs of transport, fees and maintenance

and are normally tenable for a period of two years. They may be utilized for (*a*) works training in industry, (*b*) postgraduate university study, or (*c*) a combination of these. Candidates must be Canadian citizens or British subjects normally resident in Canada and should preferably be less than 27 years of age. Further information and application forms may be obtained from the Secretary of the Faculty.

THE UNIVERSITY OF MANCHESTER TORONTO FUND

The University of Manchester has accepted the gift of a sum of £1,699 from a Committee representing the parents of children who during the war were evacuated to Toronto and other places in Canada. The capital and any income arising therefrom will be used to make grants to Canadians wishing to conduct post-graduate studies and/or research in the University of Manchester, preference being given to students who have graduated from the University of Toronto. The total amount of grant or grants to any student will not exceed £100. Applications must be submitted to the Registrar of the University of Toronto on or before January 1st of the year in which the applicant wishes to enter the University of Manchester, together with transcripts of undergraduate and graduate record and outlines of the post-graduate studies and/or research to be followed at the University of Manchester.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond

Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham. The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. To be eligible, students must have obtained not less than sixty-six per cent. at their last annual examination. Further information may be obtained from the Secretary of the Faculty.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty.

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminar courses, and private studies intended for advanced students engaged in research work. The University Library maintains also reserved book reading-rooms in University College and in the Economics Building.

During term the hours, except on Sundays and holidays, are:

University Library............................8.45 a.m. to 10.00 p.m.
(6 p.m. on Saturdays)
University College reading-room.................8.45 a.m. to 10.00 p.m.
(12.30 p.m. on Saturdays)
Reading Room, Economics building..............9.00 a.m. to 5.00 p.m.
(12.00 noon on Saturdays)

During the summer and winter vacations, the Library building is open from 9 a.m. to 4 p.m. (except on Saturdays and Sundays); and the two reading-rooms are closed.

Books in general demand may not be taken out of the Library until 3 p.m., when they are lent for the night, to be returned by ten o'clock the following morning. On Friday afternoons, these books are lent for the week-end. Books in the main library not in general demand may, on application, be borrowed for a longer period.

Many of the departments of the University, especially those that maintain laboratories or are at some distance from the University Library, have "departmental libraries"; but these, though authorized by the Library Committee of the Senate, are under departmental control, and books from the main Library are transferred to them at the discretion of the Librarian of the University. The regulations governing the use of books in the departmental libraries are determined in each case by the department concerned, and vary from one department to another. Transfer of a particular book to one of these libraries is indicated in the public catalogue in the main Library.

In the University Library students of the humanities possess an extensive laboratory. It is not only a storehouse, but a workshop in which selected materials are indexed and arranged so as to be useful. The Library does not attempt to supply textbooks; but for general and specialized reading it possesses more than half a million volumes. It subscribes to about four thousand periodicals, and is a Canadian depository for United Nations publications.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical, Engineering, Mechanical, Mining and Wallberg Buildings for convenient reference.

These departmental libraries are situated as follows:

Applied Physics	Room 22, Engineering Bldg.
Chemical Engineering	Room 2001, Wallberg Bldg.
Civil Engineering	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering	Room 25, Electrical Bldg.
Geological Sciences	Room 74, Mining Bldg.
Mechanical Engineering	Room 135, Mechanical Bldg.
Metallurgical Engineering	Room 37, Mining Bldg.
Mining Engineering	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment fo the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit

machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle 400,000-℔. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 ft. in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-℔. screw power universal testing machine, taking beams 18 ft. in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-℔. screw power universal testing machine, a Riehle 20,000-℔. screw power universal testing machine, an Olsen 20,000-℔. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-℔. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-℔. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-℔. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-℔. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure—apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

The Mining Engineering laboratories are located in the Mill Building which is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part of the third are occupied by the assaying

laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storeroom.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similiarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated-pier.

Modern equipment for the physical detection and estimation of radio-activity in ores occupies a special room on this floor.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORIES

The rock crushing section includes gyratory, jaw and rolls crushers, disc grinders and screening equipment. The grinding section includes ball and rod mills of several sizes together with working models of modern classifiers. Gravity concentration is demonstrated on Wilfley and Deister tables, corduroy blankets, jigs, sink and float unit, and a Humphrey spiral.

Flotation of ores is performed with either laboratory testing machines or a complete circuit including grinding unit, classifier, conditioner and a six cell Fahrenwald Sub A flotation machine, a pilot Wilfley and a thickener. Another laboratory is fully equipped with testing equipment for grinding, flotation, cyanidation, filtration and magnetic separation tests.

There are also space and equipment for the teaching of the principles of sampling materials in various states of division or suspension.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

This laboratory is located on the ground floor of the Mechanical Building and comprises an experimental boiler house and a large engine room with special test-bays for internal combustion engines.

The equipment includes: three experimental boilers with stokers and auxiliaries; an injector test-rack with several injectors of different type; impulse steam turbine with hydraulic dynamometer, condensing plant and auxiliaries; reaction type steam turbine with electric dynamometer, condensing plant and auxiliaries; uniflow steam engine; large low speed steam engine with condensing plant; tandem-compound steam engine with condensing plant; two small high speed back pressure steam engines; cross-compound steam driven air compressor; low speed gas engine; medium speed compression-ignition oil engine; hot-bulb ignition two-stroke oil engine; industrial type high speed gasoline engine; two automotive type gasoline engines; automotive type compression-ignition oil engine; four variable compression engines suitable for research and testing of fuels; fuel injection spray characteristics test bench.

Prony brakes, rope brakes, hydraulic dynamometers, engine indicators, steam calorimeters, air measuring equipment, fuel measuring equipment, exhaust gas analysis apparatus, and instruments such as gauges, thermometers, thermocouples, pyrometers, potentiometers, electric metering equipment, etc., are provided where required.

FUEL TESTING LABORATORY

This laboratory is located on the second floor of the Mechanical Building. Facilities are provided for both undergraduate and research study. The equipment includes precision balances, drying ovens, electric furnaces, a peroxide bomb calorimeter, an oxygen bomb calorimeter,

flow calorimeter for gaseous fuels and flow calorimeter for liquid fuels, fuel injection spray characteristics research and test equipment, octane rating testing equipment.

HEAT TRANSFER LABORATORY

The laboratory is arranged on three floor levels in the Mechanical Building, with fluid circulating systems serving all levels through a vertical pipe hatch. Facilities are provided for both undergraduate and research study in the several mechanisms of heat transmission. The equipment includes 24″ and 8″ guarded hot plates and 2″, 3″ and 8″ guarded pipe apparatus for thermal conductivity determinations, together with complete control and measurement recording systems; a multi-purpose constant temperature room, 12′ × 12′ × 9′, providing accurately controlled atmospheres at temperatures from − 30°F. to + 120°F.; Inglis concentric fin-tube, and shell-and-tube industrial type heat exchangers specially fitted for experimentation, together with controls and auxiliaries; and a gas-fired boiler system supplying steam for rating tests of radiators and convectors.

REFRIGERATION AND AIR CONDITIONING LABORATORY

This laboratory is located on the third floor of the Mechanical Building. Refrigeration equipment includes an ammonia cold storage plant, freon systems for air conditioning, deep freeze unit for temperatures to 120 degrees below zero Fahrenheit, and small demonstration refrigerators of both compression and absorption type. Air conditioning equipment includes fans of centrifugal and axial flow types, steam and water heating coils, water and refrigerant cooling coils, water spray and wet cell type air washers for humidification and dehumidification, and three systems of air ducts for the study of air flow. Also various types of heat exchangers are used with both refrigeration and air conditioning equipment.

HYDRAULIC LABORATORIES

The Hydraulic Laboratories, located in the Mechanical Building are designed and equipped to provide adequate facilities for instruction and research in all phases of fluid mechanics. The laboratories are divided into two main sections—that in which turbines, pumps, pipe flow problems, fluid measurements, etc., are carried out and a new laboratory in which open channel flow problems and similar allied subjects will be attacked.

(a) The first laboratory is located in the older wing of the Mechanical Building, occupying two floors, each of 40 ft. x 112 ft. area. In this laboratory teaching and research are carried out in several branches of hydraulics. Among the subjects considered are the measurement of the flow of gases and liquids, friction losses in pipes and fittings, the performance of turbines, pumps, compressors and fans, with special studies such as water hammer in pipe lines and cavitation in machines.

The laboratory equipment includes five centrifugal pumps capable of supplying ten cubic feet flow per second to the laboratory supply system, a Belliss and Morcom Steam Engine driving some of these pumps, various weirs, orifices, meters, experimental pumps, a complete turbine, test stand, impulse, Francis and Kaplan turbines, glass-sided channel, measuring tanks, large scales and numerous other equipment.

(b) A new Open Channel Flow Laboratory is located in the new wing of the Mechanical Building. This laboratory occupies the whole basement of the wing and is 200 ft. long by 60 ft. wide. Water is supplied by three axial flow pumps of total capacity 9000 I.G.P.M. Through a rather novel design, all of the supply pipes are carried in trenches below the floor in such a way that water may be delivered to an experiment located in any part of the laboratory and the discharge returned to the sump through troughs also located below the floor level. Constant head conditions are maintained by a head tank having 600 feet of spillway crest. A towing channel 200 feet in length is located along one side of the laboratory equipped with a light car running on steel rails. There is also a glass-sided testing flume 3 ft. wide by 3 ft. in depth, available for model testing and research.

This laboratory is designed to permit the carrying out of model tests and all experimental and teaching work on subjects such as open channel flow, wave experiments, erosion studies, hydraulic jump studies, seepage through soils, and similar work.

MECHANICAL LABORATORY

The Mechanical Laboratory, located in the west wing of the Mechanical Building, provides facilities for experimentation in Lubrication, Bearing Friction, Efficiency of Power Drives, Static and Dynamic Stress Analysis, Speed Fluctuation and Governing, Determination of Critical Shaft Speeds, Vibration Measurement and Control, Balancing, and Fine Measurements.

The Gauge Room, air conditioned by a separate system, contains a J. & L. Optical Comparator, Sheffield External and Internal Comparators, a Brush Surface Analyser, Toolmaker's Microscopes, a P. & W. Supermicrometer, a DoAll Inspection Set, Optical Flats, sets of Gauge Blocks, thread and gear measuring equipment, and an array of micrometers, verniers, and other small tools.

The laboratory is provided with standard apparatus for A.S.T.M. tests on lubricants, and special instruments such as vibrometers, tachometers, a strain-gauge bridge, amplifiers, an oscilloscope, a stroboscope, etc. Larger equipment comprises two Olsen Static-Dynamic balancing machines, a Photoelastic Polariscope, a punch press fitted with strain gauges, two single cylinder gasoline engines, and specially designed machines for the testing of belts, worm gear reducers, journal and antifriction bearings, and the calibration of speed measuring instruments.

INDUSTRIAL LABORATORY

The Industrial Laboratory is designed to give students some practical experience in the basic principles of Industrial Management. Problems are worked on a variety of phases of site selection and plant layout, with special emphasis on economic considerations. Experiments are performed to illustrate methods used in industry in such subjects as motion study, including micromotion study, time study, material handling, statistical quality control, training methods and training aids. There are seminar discussions on problems of Industrial Relations. The laboratory is also being equipped for post-graduate and research work.

MACHINE DESIGN LABORATORY

The Machine Design laboratory occupies about 3,600 square feet of floor space on the top floor of the new Mechanical Engineering Building with sufficient specially designed designed desks to accommodate over 100 students at one time. This room has excellent lighting with continuous windows on three sides, two wide north-light skylights, and fluorescent lights.

With convenient freight elevator service practically any type of machine or model can be moved into the Machine Design laboratory for demonstration, instruction, and study.

MACHINE AND WELDING SHOPS

These shops have a floor area of about 2,600 square feet on the ground floor and are serviced by a four ton freight elevator.

The machine shop equipment includes: engine lathes, a turret lathe, milling machines, shapers, drilling machines, grinding machines, saws, and an air compressor (supplying air to all laboratories). The machine tools have been selected to illustrate various types of individual motor drive, and the use of both mechanical and hydraulic table feeds.

The welding shop equipment includes an arc welding machine, and oxy-acetylene welding and cutting torches. The welding shop is partitioned off from the machine shop and is provided with a separate exhaust fan.

These shops have a fourfold purpose. (1) Demonstration of machine tools, machining and welding methods, and time and motion study procedures. (2) Research and post-graduate work in metal cutting and welding. (3) Construction of research and other special equipment. (4) Maintenance work for all laboratories.

CHEMICAL ENGINEERING LABORATORIES

The Wallberg Memorial Building houses the Department of Chemical Engineering. That part of the building occupied by the department has been especially designed and equipped for the instruction of students in chemical engineering.

The general undergraduate chemical laboratories provide facilities for all engineering students taking chemical laboratory work. There are also

rooms devoted to special instruction in fundamental chemical principles, many of which also find application in industrial laboratories; for example, polarimetry, the measurement of hydrogen-ion concentration, gas-analysis, calorimetry as applied to fuels, quantitative organic analysis, colorimetry. A full-time glass-blower not only makes the increasingly complex glass apparatus required for chemical work, but also gives students instruction in the elements of glass-blowing as a regular part of their course.

Research laboratories designed for occupancy by one or two students provide excellent facilities for graduates proceeding to the M.A.Sc. and Ph.D. degrees.

The chemical engineering laboratory is a room 56′ x 72′ running through two floors, the upper floor being in the form of grill-work over about half the area with an open well in the centre. This makes it possible to erect equipment of a small-scale industrial type. A travelling crane permits easy handling of heavy pieces of equipment. Off one corner of the laboratory there is an apparatus shaft 8′ x 12′ running through to the roof, with grill-work at each floor. This provides 65′ head-room for experimental work on certain types of operations that are becoming industrially important. The principal items of permanent equipment in the chemical engineering laboratory are a 24-plate experimental still, a triple-effect evaporator, a climbing-film evaporator, two plate and frame filter presses, a rotary filter, two heat exchangers, a vacuum drier, a gas-absorption tower, a crusher, a ball mill, a Werner-Pfleiderer shredder, a sulphonator, autoclaves for hydrogenation, a steam-heated evaporating pan, and general-purpose pumps and tanks. Undergraduates use nearly all this equipment as part of their course, studying, for example, the principles of distillation, gas-absorption, heat transfer, filtration; and carrying out small-scale industrial operations in this typical equipment. For example, they transform benzene into phenol by recognized procedures, and hydrogenate (i.e. "harden") a vegetable oil to a solid fat.

Apart from this general chemical engineering laboratory, which can be used for research purposes as well, there are three chemical engineering research laboratories, which consist of rooms 16′ x 21′ containing only the usual services. These will permit carrying out projects involving the construction of special equipment. There is also a room of about the same size containing 8 reinforced concrete cubicles for carrying out high-pressure work in autoclaves.

A machine shop 31′ x 17′ containing representative equipment provides the necessary machine-shop service to the chemical engineering laboratory in particular and to the department in general.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. Several motor generator sets are available for experiments on synchronous and induction machine. Transformers and alternating-current motors of various types; a model transmission line; a special 25-h., 22-pole, 60-cycle synchronous machine; and necessary instruments and auxiliary apparatus are available.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is

treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

ENGINEERING ELECTRONICS LABORATORY

The Engineering Electronics Laboratory, located on the top floor, is equipped for experiments on electronic applications in the industrial power frequency fields. The equipment includes cathode ray oscillographs of twin beam and conventional types, hot cathode rectifiers, pool cathode mercury arc rectifiers, thyratrons, ignitrons, photo-electric cells and the necessary auxiliary equipment such as power supplies, transformers, amplifiers, and measuring instruments. The equipment is so designed that circuits for the study of fundamental principles may be arranged easily and quickly. While typical commercial tubes and components are employed, they are used in such a manner as to give the greatest educational value rather than to illustrate finished commercial products.

METALLURGICAL ENGINEERING LABORATORIES

The laboratories occupy some 14,000 square feet of floor space in the Mining Building which is distributed between extractive metallurgy, physical metallurgy and ceramics.

The extractive metallurgy laboratories are located in two large rooms in the basement. One of these is equipped with gas furnaces for melting, heat treatment, and reduction, while the other houses the electric furnaces.

The electric furnace laboratory is fitted with the following: A 50 H.P. motor-generator set provides 60 cycle current at various voltages between 27.5 and 550. A 200 Kva transformer provides 25 cycle current at various voltages between 30 and 120. These services supply resistance furnaces of special design and also operate standard electric furnaces of arc and induction type. A 100 Kva direct arc furnace and a 15 Kva Detroit rocking furnace are available. Induction furnaces include 7.5 Kva and 15 Kw spark oscillators and a 15 Kw Northrup mercury arc oscillator. The laboratories contain outstanding equipment for conducting metallurgical reactions in vacuo and special atmospheres.

The laboratory for metallurgical analysis is well equipped to give students training in the analysis of mill and smelter products, ferrous and non-ferrous alloys, and specialized ceramic bodies. This laboratory includes a Hilger medium quartz spectrograph.

The physical metallurgy laboratories are located on the second floor. Grinding and polishing rooms include standard polishing wheels and hydraulic press for specimen mounting. The metallography laboratory is equipped with a horizontal Bausch and Lomb photomicrographic camera, research "metalloscope" and a number of desk type metallurgical microscopes.

The testing laboratory contains an Olsen universal testing machine, Rockwell hardness tester and a Tukon micro-hardness tester, etc.

There are four well-equipped dark rooms for the developing and printing of photographs and micrographs.

The atomic structure of metals can be examined by means of two Phillips X-ray Diffraction machines, which are fitted with various types of cameras (powder, back-reflection, etc.) for various uses.

The laboratory workshop is well equipped with the usual machine tools and also includes welding equipment as follows: D.C. arc, oxyacetylene, spot welder, and atomic hydrogen welder.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for reception.

UNIVERSITY SURVEY CAMP

(A) Gull Lake Survey Camp

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, and Mining Geology, as well as for other students taking special work. The country is broken and rolling,

and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

(B) Dorset Survey Camp

On account of the large number of students in Civil Engineering, accommodation at the University Camp at Minden has not been sufficient and the University has made arrangements with the Department of Lands and Forests to carry on a camp at the Forest Ranger School, 8 miles south of Dorset at the same time as the Minden Camp. During the past four years Civil Engineering students have reported at this School. This property, about 17,000 acres in extent, belongs to the University and a large number of permanent buildings have been constructed by the Department of Lands and Forests with excellent accommodation which the Department has made available for students. The class has been divided between the two camps with the exception that all students taking Mining and Mining Geology report at Minden. A daily bus service operates from Lindsay to this school.

The charge for accommodation at each camp in 1951 is estimated at $2.50 per day. A copy of instructions will be distributed to each student.

Mail, telegrams,and messages should be addressed to University Survey Camp, Minden, Ontario, or to Forest Ranger School, Dorset.

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined

measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

GEOLOGICAL LABORATORIES

Facilities are available in the Department of Geological Sciences for the practical study of geology, mineralogy and palaeontology at both the elementary and advanced levels. Extensive suites of minerals, rocks and fossils are used as an illustrative adjunct to lecture courses. These include specimens typical of Canada as well as foreign material. Standard laboratory equipment such as microscopes and section cutting equipment is maintained to assist in the study of the material. There is an up-to-date library of geological and topographic maps of Canada as well as countries

outside the Dominion, and there is a draughting laboratory equipped with light tables. For advanced students there is a fully equipped modern petrological laboratory, including photomicrograph and dark room facilities, a geochemical laboratory, a laboratory equipped with apparatus for geothermometrical and geobarometrical study, and a sedimentation laboratory.

A modern mineralogical laboratory is equipped with optical and X-ray goniometers, a Berman microbalance and other apparatus for the advanced study of minerals. An extensive reference collection of standard X-ray powder patterns is available.

ROYAL ONTARIO MUSEUM

Archaeology, Geology and Mineralogy, Palaeontology, Zoology, Division of Education

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum.

The Museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free to the public on Tuesday, Thursday, Saturday, and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of its own students in respect of all matters arising or occurring in or upon its respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SECTION XIV—UNIVERSITY HEALTH SERVICE

I. *Membership:* Membership in the University Health Service is obligatory for all students, with the following exceptions:

(a) Women living in residence at Victoria College, for whom the College provides its own Health Service.

(*b*) Students in the Pass Course for Teachers, in courses leading to the degrees of Bachelor of Science in Medicine, Bachelor of Science in Dentistry and Bachelor of Pedagogy; and certain graduate and occasional students.

Those for whom the fee is not compulsory may be granted membership on payment of the fee, provided this is done at the time of registration.

II. *Objective:* The objective is the preservation and promotion of the health of the students.

III. *Facilities:* The Health Service maintains a close liaison with the Medical Service of the Department of Veterans Affairs.

(1) Medical Examination. By order of the Board of Governors, a medical examination by the Health Service is compulsory for:
(a) Undergraduate students in their first year of attendance at the University. This examination is to be completed within one month of registration. Thereafter, the examination is to be repeated following any serious illness or accident.
(b) Any undergraduate student who, at the previous year's examination, was placed in a Category below B, i.e. B(NS), B(NBC), D, and E.
(c) Any student, graduate or undergraduate, whose domicile is not in Canada. This examination is to be completed annually within one month of registration.
(d) Any student, graduate or undergraduate, where the Health Service has reason to believe that such an examination is necessary in the interest of the health of the student or of the public.
(e) Any student, graduate or undergraduate, annually, before participating in organized competitive athletics. The Health Service shall have the right to debar any student on medical grounds from participating in athletics, and also to recall any athlete for examination.
An opportunity will be afforded annually for all students to have a medical check-up if they so desire.

(2) X-Ray Chest Survey for Pulmonary Tuberculosis. By order of the Board of Governors, the following groups of students

must have an x-ray examination of the chest as arranged by the Health Service:

(a) All new students.

(b) All final year students.

(c) The following students annually:

  (i) Medical students.

  (ii) Students of the School of Nursing.

  (iii) Students whose domicile is not in Canada.

(d) Dental students in their first year and last two years.

(e) Any student for whom it is considered necessary.

(3) A Clinic Service. Any student may consult a Staff Physician at the Health Service between the hours of 9 a.m. to 4.30 p.m., Monday to Friday, and 9 a.m. to 12.30 p.m. Saturday, while the University is in session.

It is essential that students should develop a sense of personal responsibility for the preservation and promotion of their own health, and if they are not enjoying good health, they are urged to consult a physician at this clinic.

(4) Athletic Injury Service. The University does not accept any responsibility for injuries sustained by students while engaged in physical education classes or in University athletic activities, but through the Student Health Service, provides for treatment within the following limits Minor conditions are treated at its offices and at Hart House Surgery during certain hours. In the case of more serious injuries requiring specialist or hospital care, it will provide further treatment within the limits set out hereafter, provided such treatment is taken under the direction and care of staff retained by the Health Service. Treatment is limited to students who have paid the Health Service fee, and who suffer accidents while engaged in, and which arise out of University physical education classes and competitive athletics or physical recreational activities, other than skiing, sponsored by the University of Toronto Athletic Association, the Women's Athletic Association, and by the Hart House Squash Club. Members of the University and Interfaculty Ski Squads, if registered as such with the University of Toronto Athletic Association, are covered while skiing as members of such Squads.

In order to qualify for these benefits, it is necessary to notify the Health Service of injuries within twenty-one days of their occurrence. It shall be the student's responsibility to provide proof of his eligibility for this treatment.

Benefits. If such injuries shall necessitate within 90 days from the date of accident, any of the following benefits, the Health Service will provide:

(*a*) Hospital and Infirmary Benefits. The actual cost of confinement to a licensed hospital or a University Infirmary, but not exceeding $7.00 per day in the case of hospital and $5.00 per day in the case of Infirmary; and for a total period not exceeding ninety days in respect of any one accident to any one student.

(b) Certified Specialist Fees. The proper fees of legally qualified and certified specialists in any branch of medicine or surgery, but not exceeding the fees provided for such services in the Ontario Medical Association Schedule of Fees; and in no event exceeding $200 if such injured student is hospitalised for twenty-four or more hours, or $100 for all other cases.

(c) Miscellaneous Expenses. The amount expended but not exceeding $100 in any one case for the services of an anaesthetist, the use of an operating room, x-rays, surgical dressings or medicine, if such services and supplies shall be provided in a licensed hospital. Ambulance charges are included in the above.

(d) Dental Fees. The cost of dental x-rays and dental fees not exceeding $100 for the treatment of injury to sound, natural teeth.

(e) Other Insurance. Where a student is eligible for similar benefits under any other prepaid plan, the University Health Service shall be responsible only for that amount in excess of those other benefits and up to the limits above stated.

Exclusions. The benefits provided by the Athletic Injury Service shall not cover injuries sustained in transit to or from the specified activities. Nor shall it cover hernia or bacterial infections (except pyogenic infections which shall occur through an accidental cut or wound) or any other kind of disease. Nor shall it cover any injury caused directly or indirectly, wholly or partly, by willful misconduct or rowdyism, or by bodily or mental infirmity. Nor shall it cover any costs as the result of accident causing miscarriage, abortion, or aggravation of pregnancy.

(5) Health Education. The Health Service provides health education through individual consultations and at times by lectures on subjects related to the preservation and promotion of health.

For students living away from home who have not a private physician, the following services will, when available, be provided for a nominal additional charge. In the case of students on rehabilitation grants, these charges will be borne by the Department of Veterans Affairs.

(6) A Visiting Service. An initial visit only will be paid for advice and disposal. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) is made for this visit and is payable to the Chief Accountant.

(7) An Infirmary Service. This service is for the treatment of minor illnesses only, and is available from October 1st to May 15th, and during the actual session only. A charge of $3.00 per day, payable to the Chief Accountant, is made to cover cost of meals, nursing and routine medications.

IV. *Appointments.*

(a) *Medical Examinations.* These examinations commence immediately after Labour Day in September. The examinations are by appointment only, which may be made either by telephone or in person at the Health Service offices.

The importance of keeping and being on time for the appointment as made, cannot be over-emphasized. Undergraduate students in their initial year of attendance at the University, students whose domicile is not in Canada, and all students, graduate or undergraduate, proposing to engage in athletic activities, will be examined first. The remaining years will be offered an opportunity for this examination in succession. Examinations must be completed before March 15th.

(b) *X-Ray Examination of Chest.* The Tuberculosis Survey takes place early in the Autumn Term. Arts Men students, and all women students, make their appointments in person at their respective Health Service offices. Appointments for Men students in faculties other than Arts are made through their Class Presidents.

The *Varsity* should be carefully watched for notices relative to all appointments.

V. *Communicable Diseases.* Any student who has suffered from one of the communicable diseases must report to the Health Service prior to returning to the University.

VI. *Students Whose Domicile is not in Canada.* All such students are required to submit with their formal application, a certificate by a qualified medical practioner stating that:

(1) the student is in good health and free from contagious or infectious disease, and fit to pursue his proposed course of study at this University.

(2) In addition, an x-ray film of the chest has been made within one month of the certification, and shows no evidence of tuberculosis.

They are further warned that their registration is conditional on their passing the required health examination by the University Health Service, which includes an x-ray of the chest and which must be completed within one month of registration.

VII. *Fee:* The Health Service Fee is included in the "University Incidental Fees" and is paid at the time of registration.

VIII. *Directory:*

	Address	*Telephone*
Health Service (Men)	43 St. George St.	MIdway 9644
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		
Health Service (Women)	43 St. George St.	MIdway 2646
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		

N.B. This office is closed during vacation periods. At these times, general information may be obtained from Health Service (Men), and those eligible for service may make an appointment to see Dr. Frances Stewart or her substitute at her private office, by telephoning KIngsdale 7537.

Hart House Surgery	Hart House	MIdway 5838
Hours Open: Monday to Friday, 5 to 6.30 p.m. (during actual session only)		local 201
Infirmary (Men)	42 St. George St.	MIdway 3017
Open October 1st to May 15th.		
Infirmary (Women)	Women's Union 79 St. George St.	KIngsdale 8163
Open October 1st to May 15th.		

Accidents which occur after 6:30 p.m. (or 1 p.m. on Saturday), or which are of a sufficiently serious nature as to require immediate hospital attendance, should be taken:

Men: To the Emergency Department, Toronto General Hospital, College St.

Women: To the Emergency Department, Women's College Hospital, 76 Grenville St.

To obtain a physician after hours call KIngsdale 8163, if no answer, call KIngsdale 1911. and ask for the University Health Service physician.

REQUIRED PHYSICAL EDUCATION—MEN

By order of the Board of Governors each man proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first and second years of his attendance at the University. The physical education requirements include a swimming test which must be taken before November 1st by all first year men and by men admitted to the second year from other Universities. Swimming classes are compulsory for all students who fail to pass the swimming test. All men required to take Physical Education must register at the Key Office in Hart House before October 15th.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year. The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the second year will not be permitted to register in the fourth year. Furthermore, the student who has failed to complete satisfactorily all requirements in Physical Education will not be allowed to receive the Bachelor's Degree.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

REQUIRED PHYSICAL EDUCATION—WOMEN

By order of the Board of Governors each woman proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first year of her attendance at the University. The physical education requirements include a swimming test which must be taken before October 20th by all First Year Women. Swimming classes are compulsory for all students who fail to pass the required swimming test. All women required to take Physical Education must register at the Physical Education office, 153 Bloor Street West, before October 1st.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first year must take this work during the second year of her attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, a tuck-shop where light refreshments are served, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, photographic rooms, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily. Meals are served to students in the Great Hall from Monday to Saturday lunch. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, and the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of five of these (House, Library, Music, Art, and Debates) together with certain appointed representatives, sit on the Board of Stewards, the governing board of the House, which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Graduate Secretary's office for election by the Membership Committee.

Graduate students, graduates of this university resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is under the direct administration of the University of Toronto.

Control of the Theatre is vested in a Board of Syndics appointed by the Board of Governors. The purpose of the Theatre is the encouragement of Dramatic Art in all its aspects, particularly among the undergraduates of the University. The Theatre has a resident director and competent staff who are available for consultation and assistance. Their main activity is the production of a series of plays with all-student casts.

The Theatre was founded by the generosity of the trustees of the Massey Foundation, particularly the Right Honourable Vincent Massey and Mrs. Massey. Under the Massey Foundation and with the assistance of outstanding directors the Theatre has established an enviable reputation in Little Theatre activity throughout North America.

THE SOLDIERS' TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Armed Services in the World Wars of 1914-1918 and 1939-1945, the graduates erected the Soldiers' Tower at the southwest corner of Hart House. The names of the fallen are engraved in stone, on a Memorial Screen, and on tablets under the Tower.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the University. The Students' Administrative Council publishes *The Varsity*, *Torontonensis* and the *Students' Handbook.* It represents the students at University functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Applications for loans must be made to the General Secretary-Treasurer of the Students' Administrative Council. The maximum loan is $100.00.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The University Symphony Orchestra, University Mixed Chorus and University of Toronto Band are activities of the Council in which undergraduates of the University may participate. The Council through its Radio Committee conducts courses in announcing, script writing and casting which are for undergraduates. These are under the direction of competent instructors from the C.B.C.

Through its organizations such as the Blue and White Society and the All Varsity Revue, the Council endeavours to promote a University consciousness and loyalty amongst the undergraduate body.

The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund for students in the final two years of their courses. The fee also covers the administration costs of the Students' Administrative Council.

The Students' Administrative Council is prepared to make to ex-service personnel emergency loans pending receipt of their entitlements under the Educational Benefits provided in the Post-discharge Re-establishment Order

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

- the President of the University,
- seven members of the faculty, appointed by the President,
- two graduates, appointed by the Athletic Advisory Board.
- the Director of University Health Service, the Director of Athletics and the Financial Secretary (*ex-officio*),
- five undergraduates, elected annually, from the student body,
- an undergraduate representative, appointed by the Men Students' Administrative Council.

Under the authority of the Board of Governors the Athletic Directorate shall have full control of the administration of the funds of the Association, which are used in furthering the development of competitive and recreational athletics for University students.

The Directorate subject to the approval of the President is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Education available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

- the President of the University,
- two women members of the faculty, appointed by the President,
- the Assistant Director of University Health Service in charge of Women, the Director of Physical Education for Women, and the Financial Secretary (*ex-officio*),
- six women undergraduates, elected annually,
- one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate also controls and administers the voluntary programme in Athletics and Physical Education available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Under the authority of the Board of Governors, the Women's Athletic Directorate administers the funds of the Association which are used to further the development of competitive and recreational athletics for undergraduate women.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.
(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.

(*f*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.
(*g*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.
(*h*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.
(*i*) The Debating Club of the Engineering Society, composed of the undergraduates in all courses.

These clubs devote themselves to subjects of special interest to their members. Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, confer-

ences, lectures, work projects, and social services in the down-town district. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the S.C.M. offices in Hart House and the Household Science Building.

ENGINEERING CHRISTIAN FELLOWSHIP

The Engineering Christian Fellowship is a group of engineering students from each branch of engineering that meet regularly to increase their knowledge and experience of the Christian Faith. They also seek to present the challenge of Christ's claims to their fellow students and to make these claims relevant to them as engineers.

The ECF is one of six such Varsity campus groups, all members of the Inter-Varsity Christian Fellowship which in its turn is part of a world-movement among students. The Engineering Christian Fellowship has been active for a number of years now and maintains a programme of daily devotions, Bible discussions, and special weekly features. Occasionally, it joins the other Fellowship groups on the campus for special series of addresses, worship services, or weekend conferences.

The Engineering Christian Fellowship seeks to encourage a whole-hearted allegiance to Jesus Christ as Lord and Saviour. However, it welcomes into its Fellowship those of all views and backgrounds and seeks to demonstrate its Christian convictions in an atmosphere of friendship. Further information as to its activity is published regularly in *The Varsity* or may be secured by phoning the Inter-Varsity Christian Fellowship office at KIngsdale 4188.

UNIVERSITY OF TORONTO
UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division course was designed by the Royal Canadian Navy to provide an opportunity for suitable young men in Canadian Universities to perform officer training while they are undergraduates and prepare themselves thereby for promotion to commissioned rank in the permanent or reserve force upon graduation.

Men who are accepted are entered in the lowest rating of the branch for which they apply. Before February 1st of their year of joining, they are advanced to Cadet R.C.N.(R) after having successfully passed a selection board. Upon graduation a Cadet may be promoted to Acting Sub-Lieutenant in the R.C.N. or Sub-Lieutenant in the R.C.N.(R).

Cadets are trained in the Executive, Engineer, Electrical, Supply, Ordnance, Medical, Instructor and Special Branches of the Navy. Entry to some of these Branches has as a prerequisite, training in particular academic courses.

(*a*) The Engineer Branch is open to Engineering students other than those listed in (*b*).

(*b*) The Electrical Branch is open to students in Electrical Engineering, Engineering Physics and Mathematics and Physics.

(*c*) Students in Pre-Medicine or Medicine are entered in the Medical Branch. However, medical training and interneship are not taken until a Cadet has finished first medical year and one year of general naval training.

(*d*) Students in Arts and in Commerce and Finance, may be entered in the Supply Branch.

(*e*) Students in Chemical Engineering may be entered in the Ordnance Branch.

(*f*) Students in any course may be entered in the Instructor Branch but their commissions will not be confirmed until they have completed their education certificates.

(*g*) Students who do not elect to enter any of the above noted branches may enter the Executive Branch. Cadets who have completed one summer of Executive Training may elect to train for Wings Standard.

Cadets of the University Naval Training Division wear the new uniform for Cadet Officers.

Personnel of the University Naval Training Division are paid training allowance for divisional drills attended during the academic year. The total training allowance paid during the academic year is not to exceed 16 days' pay at $69.00 per month for first year men and $169.00 per month for all other years.

Cadets are required to take 14 weeks' training during the summer vacation. For this training they are paid $162.00 per month plus room and board, clothing and medical care.

Commanding Officer........Lieut. Commander R. F. McRae, R.C.N.(R)
Executive Officer...........Lieut. Commander A. A. Wedd, R.C.N.(R)
Resident Staff Officer........Lieut. E. M. Gruetzner, R.C.N.(R)

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

In view of the record of the officers who received their training in the COTC before and during the war, the Director of Military Training at Canadian Army Headquarters has stated that this Corps, together with the Royal Military College and Royal Roads, is now looked upon as the chief source of officers for the Canadian Army.

A student who completes his training in the COTC is granted a commission as a lieutenant in the Canadian Army upon graduation and may join the Active Force (permanent army), if vacancies are available, or the Reserve Force. He is, however, under no obligation to do so but may remain on the Supplementary Reserve (inactive list).

Training is organized into two portions:

(a) Practical training, sixteen weeks each summer at Active Force Schools.

(b) Theoretical training, lecture courses during two academic sessions; not more than forty lectures per year.

Pay during the summer is $162.00 per month, and for those completing each theoretical lecture course, an additional ten days' pay. During summer training, board, lodging, clothing and transportation from home or University to Corps Schools and return, are all provided free of charge.

To be eligible, students must be seventeen years of age, Canadian citizens or British subjects permanently resident in Canada, physically fit, and following a course of study leading to a University degree.

Arrangements have been made so that summer training may be accepted in part for the summer practical work required in certain faculties and courses.

Application for training should be made in person before the 30th of November to Contingent Headquarters, 119 St. George Street, Toronto. Previous experience has been that more applications are received than can be accepted. Early application is advisable.

The Contingent Staff for the session 1951-1952 is:

Honorary Colonel.........Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer........Lieutenant-Colonel L. S. Lauchland, E.D.
Second-in-Command........Major A. S. Michell
Adjutant..................Captain H. A. Webster
Resident Staff Officer........Major L. E. C. Schmidlin, M.B.E.
Resident Staff Officer........Captain F. J. Murphy

ROYAL CANADIAN AIR FORCE (RESERVE) UNIVERSITY OF TORONTO FLIGHT

In 1948-1949 a University Flight of the RCAF was established at the University of Toronto. Initially this Flight was organized as a university detachment of 400 Squadron—a Toronto-based fighter squadron of the RCAF (Reserve); but in 1949-1950 it became established as a separate Reserve Training Unit on strength of RCAF Station, Toronto.

The function of the University Flight is to foster interest in the RCAF and furnish a flow of trained university students into the Regular and Reserve Air Force as commissioned officers. Its establishment provides placement for approximately 150 undergraduates, largely but not exclusively drawn from courses in pure or applied science or medicine.

It is expected that at the commencement of the academic session 1951-1952 there will be approximately 60 vacancies in the University Flight, these being reserved entirely or largely for men of classes due to graduate in 1955. Students selected for these vacancies are appointed to the rank of Flight Cadet—a comparatively new officer rank, which may be thought of as that of an officer cadet. Before appointment as Flight Cadets, students are required to sign an undertaking that upon completion of their service in the Flight they will, for a period of five years, remain in the RCAF (Reserve) or transfer to the RCAF (Supplementary Reserve), or will accept appointment to the RCAF (Regular) if they desire and are selected for such appointment.

While serving as members of the University Flight, students are given "winter training" consisting largely of lectures during, normally, three successive academic years. Their three sessions of winter training are each immediately followed by a period of "summer training". In the case of Flight Cadets selected for aircrew, this training consists of spending three summers in qualifying to "Wings" standard as navigators, pilots or radio officers. In the case of Flight Cadets selected for other training, this consists of training and employment at appropriate schools or other units of the RCAF during summer months of three successive years. For winter training, the pay allowed each University Flight Cadet is approximately $25.00 in his first year, and $50.00 in each of his second and third years. For summer training his entitlement, ordinarily for a period of from four to five months, is $162.00 per month plus rations and quarters valued at $61.00 per month. These rates of remuneration are supplemented by certain extra allowances for those Flight Cadets who participate in winter or summer flying training.

The RCAF Orderly Room at the University of Toronto is located at 119 St. George Street, and serves as a focal point not only for affairs of the University Flight but also for other interests of students in the RCAF. In this Orderly Room, undergraduate veterans of the RCAF, RAF, or other Commonwealth Air Forces and members of graduating classes (and other interested students) may obtain information regarding full-time service in the RCAF (Regular), and file applications for appointment to such service.

In the session 1950-1951 the staff of the RCAF on the campus of the University of Toronto was as follows:

University Air Liaison Officers..................W/C T. R. Loudon, VD
S/L F. L. Hutchison
RCAF Resident Staff Officer...................F/L M. A. Everard
NCO i/c Orderly Room........................Sgt. P. G. Mickus
Officer Commanding RCAF (Reserve)
University of Toronto Flight................S/L F. L. Hutchison
Second-in-Command..........................F/L D. G. Allan

UNIVERSITY ADVISORY BUREAU

The University Advisory Bureau seeks to make its own contribution to the life of the University by providing within the University a neutral zone where the student may discuss in freedom and in confidence personal matters of the most fundamental importance to his successful development as a student, as a worker, as a citizen and as a fully effective person.

In keeping with this objective, the Bureau performs the following functions:—

(a) Through liaison with the University departments, the Registrars' offices and appropriate services on the campus, the Bureau furnishes information and assistance in the financial, educational and personal spheres. The Bureau, for instance, serves as a focal centre for applications to The Veteran-Students' Loan Fund and provides information on other loan facilities, including Navy, Army and Air Force Benevolent Trust Funds. Working with appropriate Registrars' offices, the Bureau helps the student to clarify details regarding entrance requirements, courses of study and related occupational goals. The Bureau is also available for consultation on personal questions involving adjustment to University life, assessment of interests, vocational direction and other matters of a similar nature; where advisable, students are referred to more specialized services.

(b) Liaison with D.V.A. The Bureau works closely with the Department of Veterans Affairs, both locally and with Ottawa headquarters, on all matters affecting the interests of ex-service students and in many ways serves as a campus clearing house for problems which might otherwise require to be referred to the Toronto office of D.V.A.

(c) Liaison with other universities. In contact with the Advisory Bureaus located at other Universities across Canada, the Bureau seeks to maintain up-to-date information on local variations in all fields significant to students—entrance requirements and application deadlines, courses available, length of training, degrees awarded, etc.

The Bureau is located at 67 St. George Street.

SECTION XVII. LODGING AND BOARD

Housing Service for Students

For students who are not accommodated in the University and College residences, the Students' Administrative Council prepares annually a list of inspected and approved rooming houses, flats, apartments and homes. This list may be consulted at the Housing office in Hart House after August 1st and throughout the session.

To meet the housing shortage in Toronto, the Students' Administrative Council has greatly expanded its Housing Service. Every effort is being made to provide accommodation for married ex-service students and for those who have children. Information may be obtained from the Students' Administrative Council's Housing Service office, Hart House.

Through this service many opportunities have been afforded students, including those students who are married to obtain lodging and board in exchange for part-time services. Students desiring this type of accommodation are asked to indicate this when they apply.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately two hundred men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. As early as possible during the summer preceding attendance at the University, each successful applicant will be notified of his assignment. He must then send to the Secretary of the Residence Committee a deposit of $5.00. Cheques or money orders must be made payable to the University of Toronto. The deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

The residence dues for the session (exclusive of the Christmas Vacation and based on 28 weeks) are $147.00 payable to the Chief Accountant as follows: $70.00 on or before the opening date of the session; $55.00 by November 30th; $22.00 by February 29th.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1950-51

Year	Course 1	2	3	5	6	7	8	8a	9	10	11	Total
I	78	9	74	24	79	46	11	1	13	11	59	405
II	68	7	68	23	70	73	5	1	13	8	42	378
III	106	13	111	34	80	84	17	6	10	8	57	526
IV	123	23	181	40	96	140	18	10	22	31	60	744
	375	52	434	121	325	343	51	18	58	58	218	2053

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such Council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Alumni Association Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wide sphere of University graduate activities through its membership in the Alumni Association of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Alumni Association co-ordinates the activity of all the Associations and edits and publishes the *Alumni Bulletin*, which contains news items and articles of interest to all graduates. Through class Engineering Alumni Association and Alumni Association of the University the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Association of the University; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *Alumni Bulletin* and the *Toike Oike* which is published every now and then. This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Association towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *Alumni Bulletin*.

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 141. Many part-time demonstratorships are open which permit graduate work towards a degree and research assistants are also appointed annually on salary in the School of Engineering Research. This work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE

The regulations governing the Degree of Master of Applied Science (M.A.Sc.) shall be determined as follows:

1a. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

1b. Graduate students are required to perform at least one full session's work (seven months), or its equivalent, before being recommended for the degree of M.A.Sc.

1c. A candidate for the degree of M.A.Sc. must have a good academic record in his undergraduate course and must have an average mark on written examinations of at least 65 per cent in his final undergraduate year, save in exceptional circumstances.

1d. Candidates for the degree of M.A.Sc. are required to pass written or oral examinations in not less than two and not more than five subjects, in addition to the preparation of a thesis, in fulfilment of the requirements for the degree.

2. A candidate wishing to proceed to a graduate degree shall (a) register with the Secretary of the School of Graduate Studies at the beginning of

the academic year, (b) enrol in one of the departments mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him. No applications for the degree of M.A.Sc. will be accepted where it is proposed that the research work be conducted outside the university laboratories.

3. Not later than 31st October of the academic session in which the candidate expects to obtain the degree, he shall submit to the Secretary for acceptance by the Council of the School of Graduate Studies, the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1952, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical and Ceramic Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1952, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degree of Master of Applied Science.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Electrical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1951-52 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examination in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original thesis on an engineering subject in the branch in which he has applied for a degree. The thesis shall be on work in which the candidate has had professional experience.

The thesis shall preferably be in the form of an engineer's report on the design of engineering works, or on processes of manufacture and shall indicate wherever appropriate the economic considerations for the plan adopted. Candidates for the Degree of Chemical Engineer and the Degree

of Metallurgical Engineer may, if permission to prepare a thesis on actual works or processes is not obtainable, submit a thesis on general subjects, provided that the contents are applicable to the particular branch of engineering and are comprehensive of that branch to be of value in that field.

The thesis shall be of professional grade such as would be prepared by an engineer engaged in a professional capacity to report on a project, submit a design, or propose a process. The quality of the thesis will be judged by the Board of Examiners as an indication of the candidate's professional attainments.

A thesis of a solely descriptive type wil not be acceptable.

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the month of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

High School Assistants' Certificates, Type A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 66% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS

A certificate authorizing to practice Land Surveying in Ontario is granted by the Board of Examiners of the Association of Ontario Land Surveyors on the basis of certain requirements set forth in The Land Surveyors' Act. The main requirements are:

(a) Three years apprenticeship with a practising Ontario Land Surveyor.
(b) Passing the intermediate examination.
(c) Passing the final examination.
(d) Completion of requirements as to fees, bond, oath, standard of length, etc.

The intermediate and final examinations are held annually in Toronto, usually in March.

Graduates of the Faculty of Applied Science and Engineering in the branches of Civil or Mining Engineering are granted a shortened apprenticeship of one year. Full details are available upon application to the Secretary, Association of Ontario Land Surveyors, 331 Bay Street, Toronto, or from the staff in Surveying and Geodesy.

DOMINION LAND SURVEYORS

Requirements for certificate to practice as a Dominion Land Surveyor are similar to those for the O.L.S. outlined above except:

(a) Apprenticeship with a Dominion Land Surveyor.

(b) Annual examinations in Ottawa and other points where there are sufficient candidates to justify arrangements, usually in February.

Full details are available from the Secretary, Board of Examiners for Dominion Land Surveyors, Labelli Bldg., Ottawa, Ontario.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	21
Mechanical Engineering	34
Engineering Physics	11
Chemical Engineering	24
Electrical Engineering	19
Metallurgical Engineering	22
Mining Geology	27
Aeronautical Engineering	17
Total	175

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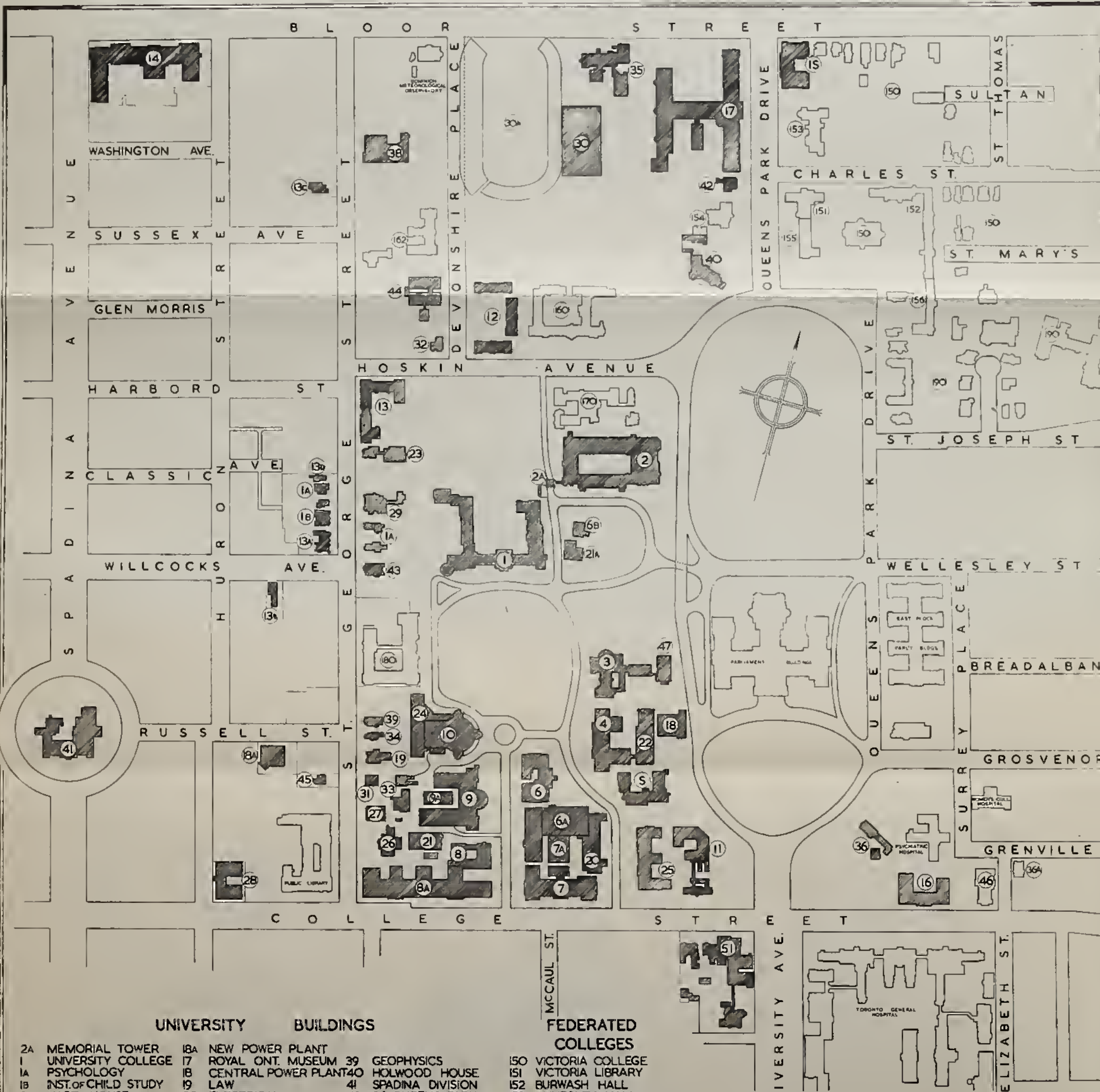

UNIVERSITY BUILDINGS

2A MEMORIAL TOWER
1 UNIVERSITY COLLEGE
1A PSYCHOLOGY
1B INST. OF CHILD STUDY
2 HART HOUSE
3 LIBRARY
4 MEDICAL
5 BIOLOGICAL
6 ENGINEERING
6A MECHANICAL
6B GEODETIC OBSERVATORY
7 MINING
7A MILL
8 CHEMISTRY
8A WALLBERG MEMORIAL
9 McLENNAN LABS
9A WORKSHOPS
10 CONVOCATION HALL
11 BOTANY
12 MEN'S RESIDENCES
13 WHITNEY HALL
13A HUTTON HOUSE
13BCD WOMEN'S RESIDENCES
14 ONT. COLL. OF EDUCAT'N
15 HOUSEHOLD SCIENCE
16 BANTING INSTITUTE
18A NEW POWER PLANT
17 ROYAL ONT. MUSEUM
18 CENTRAL POWER PLANT
19 LAW
20 ELECTRICAL
21 PRESS
21A BOOKSHOP
22 ANATOMY
23 U.C. WOMEN'S UNION
24 SIMCOE HALL
25 HYGIENE
26 BALDWIN HOUSE
27 FORESTRY
28 DENTAL
29 U.C. MEN'S RESIDENCE
30 ARENA
30A STADIUM
31 HEALTH SERVICE
32 GRADUATE STUDIES
33 SUPTS. STORES
34 APPLIED MATH.
35 ECONOMICS
36 SCHOOL OF NURSING
36A SCH. OF NUR'G RESIDENCES
38 C.O.T.C. AND MILITARY STUDIES
39 GEOPHYSICS
40 HOLWOOD HOUSE
41 SPADINA DIVISION
42 86 QUEENS PARK
43 67 ST. GEORGE ST.
44 OCCUP. & PHYS. THERAPY
45 ALUMNI ASSOCIATION
46 88 COLLEGE ST.
47 ARCHIVES
50
51 ROYAL CONSERVATORY OF MUSIC
52

FEDERATED COLLEGES

150 VICTORIA COLLEGE
151 VICTORIA LIBRARY
152 BURWASH HALL
153 ANNESLEY HALL
154 WYMILWOOD
155 EMMANUEL COLLEGE
156 EMMANUEL RESIDENCE
160 TRINITY COLLEGE
162 ST. HILDA'S COLLEGE
170 WYCLIFFE COLLEGE
180 KNOX COLLEGE
190 ST. MICHAEL'S COLLEGE

PLAN OF GROUNDS
UNIVERSITY OF TORONTO

SCALE — FEET

SUPERINTENDENT'S OFFICE

JANUARY · 1951

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science and Engineering

1952-1953

THE UNIVERSITY OF TORONTO PRESS
1952

CALENDAR 1952

Jan.

S	M	T	W	T	F	S
....	....	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	....	....

Feb.

S	M	T	W	T	F	S
....	....	....	....	....	1	2
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July

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CALENDAR 1953

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Nov.

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SECTION I. CALENDAR 1952-1953

FALL TERM, 1952

July 1	*Tuesday*	Dominion Day. Buildings closed.
July 15	*Tuesday*	Last day for receiving application for supplemental examinations.
August 4	*Monday*	Civic Holiday. Buildings closed.
August 18	*Monday*	Students of the III Year, Courses 1, 2 and 9 report at Survey Camp, Gull Lake.
August 25	*Monday*	Supplemental Examinations commence.
September 1	*Monday*	Labour Day. Buildings closed.
September 2	*Tuesday*	Last day for receiving applications for admission to the I Year.
September 8	*Monday*	Students of the II year, Courses 1, 2 and 9 report at Survey Camp, Dorset.
September 10	*Wednesday*	Special meeting of Faculty Council.
September 18-20	*Thursday-Saturday*	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m. (Saturday 9.30 a.m. to 12.00 noon) at 119 St. George Street.
September 22	*Monday*	Registration in person of the II, III and IV Years from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building. Dean's address to the I Year. Preliminary instruction to the I Year.
September 23	*Tuesday*	Lectures and laboratory work commence at 9.00 a.m. Meeting of Faculty Council.
September 24	*Wednesday*	The opening address by the President to the students of all Faculties at 3.45 p.m., in Convocation Hall.
October 1	*Wednesday*	Meeting of Faculty Council.
*October 6	*Monday*	Thanksgiving Day. Buildings closed.
October 10	*Friday*	Meeting of Senate.
November 3	*Monday*	Meeting of Faculty Council.
November 11	*Tuesday*	Remembrance Day Service at 10.45 a.m. Lectures and laboratory classes withdrawn from 10.00 a.m. to 11.15 a.m.
November 14	*Friday*	Meeting of Senate. General Meeting of Engineering Society.
December 2	*Tuesday*	Meeting of Faculty Council.
December 3	*Wednesday*	General Meeting of Engineering Society.

December 12	*Friday*	Meeting of Senate
December 19	*Friday*	Term ends at 5.00 p.m.
December 25	*Thursday*	Christmas Day. Buildings closed.
December 26-27	*Friday-Saturday*	Buildings closed.

SPRING TERM, 1953

January 1	*Thursday*	New Year's Day. Buildings closed.
January 5	*Monday*	Spring Term begins. Mid-session Examinations commence.
January 9	*Friday*	Meeting of Senate.
January 12	*Monday*	Meeting of Faculty Council.
January 15	*Thursday*	Last day for receiving the second term instalment of fees.
February 3	*Tuesday*	Meeting of Faculty Council.
February 5	*Thursday*	General meeting of Engineering Society.
February 13	*Friday*	Meeting of Senate.
February 20	*Friday*	Engineering Society Annual Elections.
March 4	*Wednesday*	Meeting of Faculty Council. General meeting of Engineering Society.
March 13	*Friday*	Meeting of Senate.
April 1	*Wednesday*	Meeting of Faculty Council.
April 2	*Thursday*	Term ends at 5.00 p.m.
April 3	*Friday*	Good Friday. Buildings closed.
April 4	*Saturday*	Buildings closed.
April 9	*Thursday*	Annual Examinations commence.
April 10	*Friday*	Meeting of Senate.
May 5	*Tuesday*	Meeting of Faculty Council.
May 8	*Friday*	Meeting of Senate.
*May 25	*Monday*	Victoria Day. Buildings closed.
June 1	*Monday*	Meeting of Senate.
June 3, 4, 5	*Wednesday Thursday Friday*	University Commencement.

* Or such other date as may be determined by Order-in-Council.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . Sidney Smith, K.C., M.A., LL.B., LL.D., D.C.L., F.R.S.C.

Registrar . . . . J. C. Evans, B.A.

Librarian . . . . W. S. Wallace, M.A., LL.D., F.R.S.C.

Warden of Hart House . . . . N. Ignatieff, M.B.E., B.SC.

Director of University Extension . . . . J. R. Gilley, B.A.SC.

Assistant to the President . . . . C. T. Bissell, M.A., PH.D.

Comptroller . . . . A. G. Rankin, B.COM. C.A.

Bursar and Secretary to the Board of Governors C. E. Higginbottom, F.C.I.S.

Superintendent of Buildings and Grounds . . . A. D. LePan, B.A.SC.

Chief Accountant . . . . G. L. Court, D.F.C., B.COM., C.A.

Director of University Health Service
G. E. Wodehouse, M.C., M.D., F.R.C.P.

Assistant Director of University Health Service—Women
Miss F. H. Stewart, B.A., M.D.

Director of Athletics and Physical Education—Men . W. A. Stevens, B.S.

Director of Athletics and Physical Education—Women Miss Z. Slack, B.A.

General Manager of the University of Toronto Press
A. G. Rankin, B.COM., C.A.

Editor of the University of Toronto Press G. W. Brown, M.A., PH.D., F.R.S.C.

General Secretary-Treasurer of the Students' Administrative Council
E. A. Macdonald, B.A.

Associate Secretary of the Students' Administrative Council
Miss A. E. M. Parkes, B.A.

Director of Hart House Theatre . . . . R. S. Gill, M.A.

Director of the Placement Service . . . J. K. Bradford, O.B.E., M.A.SC.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . . . K. F. Tupper, O.B.E., B.A.SC., S.M. (MICH)

Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.

SECTION III. TEACHING STAFF

1950-51

DEAN EMERITUS

C. R. Young, B.A.Sc., C.E., D.Eng., D.Ès.Sc.A., Hon. M.E.I.C., M.Am.Soc.CE. 72 Roxborough Dr.
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Professor Emeritus of Engineering Drawing

G. A. Guess, M.A. (Qu.) Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. Haultain, C.E. National Club
Professor Emeritus of Mining Engineering

C. G. Williams, B.A.Sc. 417 Rosemary Road
Professor Emeritus of Mining Engineering

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W. Pukalo, B.A.Sc. — 17 Heather St.
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DEPARTMENT OF ENGINEERING DRAWING

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A. Wardell, B.A.Sc. — 124 Melrose Ave.
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A. D. Fisken, Grad. R.M.C., Mem. A.S.M.E. — 47 Woodlawn Ave., W.
Special Lecturer in Engineering Drawing (part time)

C. C. Li, B.E. (Tsing Hua Univ., China), (M.S. in M.E., Mich.)
Special Lecturer in Engineering Drawing 460 Markham St.
A. D. Cummings, B.A.Sc. 160 St. George St.
Instructor in Engineering Drawing (part time)
H. R. Frizzle, B.Sc. (N.S. Tech. College), M.E.I.C.
Instructor in Engineering Drawing 289 Queensdale Ave.
J. M. Hall, B.A.Sc., Jr. E.I.C. 87 Queens Dr., Weston
Instructor in Engineering Drawing (part time)
R. C. Hinde, B.A.Sc., Jr. E.I.C. 134 Northland Ave.
Instructor in Engineering Drawing (part time)
W. D. McMurtry, B.A.Sc. 11 MacLennan Ave.
Instructor in Engineering Drawing (part time)
W. J. Major, B.Sc. (Qu.), Mem. S.E.G., Jr. E.I.C. 115 Oakwood Ave.
Instructor in Engineering Drawing (part time)
E. E. Noonan, B.A. Apt. 120, 5 DuMaurier Blvd.
Instructor in Engineering Drawing (part time)
A. M. Sheppard, B.A. 128 Flatt Ave., Hamilton
Instructor in Engineering Drawing (part time)
W. A. Skirrow, M.A. (Qu.) 111 Evelyn Cres.
Instructor in Engineering Drawing (part time)
V. Strautmanis, B.A.Sc. 65 Shannon St.
Instructor in Engineering Drawing (part time)
R. G. Tress, B.A.Sc. R.R. No. 3, Dickson Rd., Port Credit
Instructor in Engineering Drawing
A. W. Walker, M.A. 335 Brunswick Ave.
Instructor in Engineering Drawing

DEPARTMENT OF MECHANICAL ENGINEERING

E. A. Allcut, M.Sc. (Birm.), M.E., F.R.Ae.S., M.I.Mech.E.
Professor of Mechanical Engineering and Head of Department 315 Lawrence Ave. W.
W. G. McIntosh, B.A.Sc., Mem.A.S.M.E., Mem.A.S.E.E.
Professor of Mechanical Engineering 36 Poplar Plains Rd.
G. R. Lord, B.A.Sc., S.M. (M.I.T.), Ph.D., M.E.I.C. 239 Dawlish Ave.
Professor of Mechanical Engineering
R. C. Wiren, B.A.Sc., Mem.A.S.M.E., M.E.I.C. 211 College St.
Associate Professor of Mechanical Engineering
I. W. Smith, B.A.Sc., Mem.A.S.M.E., Mem.A.S.E.E. Thorncrest Village
Associate Professor of Mechanical Engineering
L. E. Jones, B.Sc., C.E. (Man.), M.A.Sc., Ph.D. 140 Divadale Dr.
Assistant Professor of Mechanical Engineering
F. G. Ewens, M.A.Sc., M.E.I.C. 300 St. Clair Ave. E.
Assistant Professor of Mechanical Engineering

P. B. Hughes, B.Sc. (McG.), M.E.I.C. — R. R. 1, Hornby
Assistant Professor of Mechanical Engineering

C. E. Olive, B.Sc. (Lond.) M.E.I.C. — R. R. No. 1, Whitby
Assistant Professor of Mechanical Engineering

W. A. Wallace, B.A.Sc., Jr.Mem.A.S.M.E., A.Mem.S.A.E.
Assistant Professor of Mechanical Engineering — 74 Glendale Ave.

F. C. Hooper, B.A.Sc. — 148 Evelyn Cres.
Lecturer in Mechanical Engineering

D. G. Huber, M.A.Sc., Mem.A.S.E.E. — 103 Yorkminster Rd.
Lecturer in Mechanical Engineering — Willowdale.

R. T. Waines, B.A.Sc., M.E.I.C. — 43 Albertus Ave.
Lecturer in Mechanical Engineering

J. W. Church, B.Sc. (Qu.) — 20 Nesbitt Dr.
Lecturer in Mechanical Engineering

R. O. King, M.A.Sc. (McG.) — Mechanical Bldg.
Special Lecturer in Mechanical Engineering

J. M. F. Vickers, B.Sc. (Birm.), M.A.Sc. — 61 Fairholme Ave.
Lecturer in Mechanical Engineering

J. R. Cavanagh, B.A.Sc. — 56 Ridley Blvd.
Special Lecturer in Mechanical Engineering (part time)

O. O. Cochkanoff, B.Sc. (B.C.) — 159 Cumberland St.
Instructor in Mechanical Engineering

S. S. Lazier, M.A.Sc. — 49 St. Clair Ave. W.
Instructor in Mechanical Engineering

P. F. O'Rourke, B.A.Sc. — 335 Beresford Ave.
Instructor in Mechanical Engineering

D. Chmara, B.A.Sc. — 677 Manning Ave.
Demonstrator in Mechanical Engineering

P. M. Emery, B.A.Sc. — 16 Rosalind Cres.
Demonstrator in Mechanical Engineering (part time)

S. V. Hayes, B.Sc. (Birm.) — 44 Fairholme Ave.
Demonstrator in Mechanical Engineering

S. Juhasz, M.Sc. (Stock.) — 20 Delavan St.
Demonstrator in Mechanical Engineering

J. C. Junkin, B.A.Sc. — 78 Hogarth Ave.
Demonstrator in Mechanical Engineering

M. J. Kenn, B.Sc. (Lond.) — 1228 Davenport Rd.
Demonstrator in Mechanical Engineering

G. T. Keys, B.A.Sc. — 11 Hollydene Rd.
Demonstrator in Mechanical Engineering

M. J. Loukides, B.A.Sc. — 106 Glenwood Cres.
Demonstrator in Mechanical Engineering (part time)

J. Luczkiw, B.A.Sc. — 2035 Davenport Rd.
Demonstrator in Mechanical Engineering (part time)

J. R. Mainprize, B.A.Sc. — 88 Kendal Ave.
Demonstrator in Mechanical Engineering

E. Matthews, B.A.Sc. — 54 Delhi Ave
Demonstrator in Mechanical Engineering (part time)

W. A. Moeser, B.A.Sc. — 8 Langmuir Cres.
Demonstrator in Mechanical Engineering (part time)

J. R. Petrinec, B.A.Sc. — 15 Braemar Ave.
Demonstrator in Mechanical Engineering (part time)

R. Y. Pogontcheff, B.A.Sc. — 39 Chaplin Cres.
Demonstrator in Mechanical Engineering

H. Staneland, B.A.Sc. — 1984 Queen Street E.
Demonstrator in Mechanical Engineering (part time)

A. L. Walker, B.A.Sc. — 84 Glenmanor Dr.
Demonstrator in Mechanical Engineering

G. H. West, B.A.Sc. — 6 Lowther Ave.
Demonstrator in Mechanical Engineering (part time)

E. R. Wilbee, B.A.Sc. — 262 Indian Rd.
Demonstrator in Mechanical Engineering (part time)

R. Williamson, B.A.Sc. — 189 Browning Ave.
Demonstrator in Mechanical Engineering

DEPARTMENT OF METALLURGICAL ENGINEERING

L. M. Pidgeon, B.Sc. (Ox.), Ph.D. (McG.), F.R.S.C. — 185 Rosedale Heights Dr.
Professor of Metallurgical Engineering

B. Chalmers, D.Sc., Ph.D. (Lond.) — 84 Douglas Ave., Oakville
Professor of Metallurgical Engineering

P. M. Corbett, B.S. (Ill.), M.S. (Penn. State) — 19 Maple St., Ajax
Associate Professor of Ceramics

H. U. Ross, M.Sc. (McG.) — 3857 Bathurst St.
Assistant Professor of Metallurgical Engineering

E. Thall, B.A.Sc. — 174 Falkirk Ave.
Lecturer in Metallurgical Engineering

DEPARTMENT OF MINING ENGINEERING

R. E. Barrett, B.Sc. (McG.) — 116 Ridge Dr.
Professor of Mining Engineering

S. E. Wolfe, M.A.Sc. — R.R. No. 1, Streetsville
Associate Professor Mining Engineering

W. A. M. Hewer, B.A.Sc. — 68 Kingsway Cresc.
Assistant Professor Mining Engineering

R. L. Christie, B.A.Sc. (B.C.) — 80 Spadina Rd.
Demonstrator in Mining Engineering

E. E. G. Heaslip, B.A.Sc. — 97 Woodycrest Ave.
Demonstrator in Mining Engineering

H. S. K. Metcalf, B.A.Sc. — 716 Palmerston Ave.
Demonstrator in Mining Engineering
W. W. Moffat, B.A.Sc. — 137 Eglinton Ave. W.
Demonstrator in Mining Engineering

OTHER SPECIAL LECTURERS

R. R. Grant, O.L.S., F.C.A. — 102 Blythwood Rd.
Special Lecturer in Accountancy and Business
P. H. Mills, B.A.Sc. — 80 King St. W.
Special Lecturer in Engineering Law

PROFESSORS OF OTHER FACULTIES GIVING INSTRUCTION TO STUDENTS IN APPLIED SCIENCE

Miss E. J. Allin, M.A., Ph.D. — Apt. 35, 8 St. Thomas St.
Assistant Professor of Physics
C. Barnes, M.Sc. (Leeds), Ph.D. — 269 St. Leonards Ave.
Professor of Physics
F. N. Beard, B.Com., C.A. — 115 Dowling Ave.
Assistant Professor of Political Economy
S. Beatty, M.A., Ph.D., F.R.S.C. — 537 Markham St.
Professor of Mathematics
V. W. Bladen, M.A. (Oxon), F.R.S.C. — 103 Woodlawn Ave. W.
Professor of Political Economy
J. D. Burk, B.A. — 30 Duggan Ave.
Associate Professor of Mathematics
M. F. Crawford, B.A. (West.), M.A., Ph.D., F.R.S.C.
Professor of Physics — 11 Washington Ave.
W. J. Crosby, M.A., Ph.D. — 268 The Queensway
Assistant Professor of Mathematics
Miss K. M. Crossley, B.A. — 76 Duplex Ave.
Assistant Professor of Physics
A. W. Currie, B.A., B.Com. (Qu.), D.Com.Sc. (Harv.) — 5 Berney Cresc.
Associate Professor of Political Economy
Miss M. A. Fritz, B.A. (McG.), M.A., Ph.D., F.R.S.C. — Apt. 2,
Associate Professor of Palaeontology — 388 Brunswick Ave.
B. A. Griffith, M.A., Ph.D. — 137 Albertus Ave.
Assistant Professor of Mathematics
J. N. P. Hume, M.A., Ph.D. — 38 Melrose Ave.
Assistant Professor of Physics
H. J. C. Ireton, M.A., Ph.D. — 76 Lonsdale Rd.
Professor of Physics
D. G. Ivey, M.A. (B.C.), Ph.D. (Notre Dame) — 16 De Quincy Blvd.
Assistant Professor of Physics

Miss C. C. Krieger, M.A., Ph.D. — 448 Spadina Rd.
Assistant Professor of Mathematics

G. B. Langford, B.A.Sc., Ph.D. (Corn.), F.R.S.C., P.Eng.
Professor of Mining Geology — 12 Austin Terrace

D. J. LeRoy, M.A., Ph.D., F.R.S.C. — 605 Oriole Pkwy.
Professor of Chemistry

W. Line, O.B.E., B.Sc. (Mt. A), M.A. (Alta.), Ph.D. (Lond.)
Professor of Psychology — 34 Burnaby Blvd.

Marcus Long, M.A., Ph.D. — 80 Walker Ave.
Assistant Professor of Philosophy

R. L. McIntosh, M.B.E., B.A., M.Sc. (Dal.), Ph.D. (McG.), F.R.S.C.
Associate Professor of Chemistry — 220 Glen Rd.

R. W. McKay, M.A., Ph.D. — 2 Havergal Gdn.
Associate Professor of Physics

A. MacLean, B.A. — 488 Spadina Ave.
Professor of Geology

V. B. Meen, M.A., Ph.D. — 34 Birchview Blvd.
Assistant Professor of Mineralogy

E. W. Nuffield, B.A., Ph.D. — Thorncrest Village, Islington
Assistant Professor of Mineralogy

W. W. Moorhouse, M.A., Ph.D. (Col.) — 138 Islington Ave. N., Islington
Associate Professor of Geology

I. R. Pounder, M.A., Ph.D. (Chic.) — 19 Glen Gordon Rd.
Professor of Mathematics

R. Richmond, M.A., Ph.D. — 41 Roslin Ave.
Assistant Professor of Physics

D. A. F. Robinson, M.A., Ph.D. (Chic.) — 302 Heath St. E.
Associate Professor of Mathematics

G. de B. Robinson, M.B.E., B.A., Ph.D. (Camb.) F.R.S.C.
Associate Professor of Mathematics — 20 Whitehall Rd.

L. J. Rogers, B.A.Sc., M.A. — 110 Garfield Ave.
Professor of Analytical Chemistry

G. D. Scott, M.A., Ph.D. — 77 Roehampton Ave.
Assistant Professor of Physics

F. G. Smith, M.Sc. (Man.), Ph.D. — 57 Prince Arthur Ave.
Assistant Professor of Geological Sciences

W. H. Watson, M.A. (Edin.), Ph.D. (Edin.) (Cantab.) F.R.S.C.
Professor of Physics — 740 Avenue Rd.

W. J. Webber, B.A. (Camb.) — 18 Kappele Ave.
Professor of Mathematics

H. L. Welsh, M.A., Ph.D. — 112 Glencairn Ave.
Associate Professor of Physics

F. E. W. Wetmore, B.Sc. (N.B.), M.A., Ph.D. — 191 Bayview Ave.
Associate Professor of Chemistry

J. T. Wilson, O.B.E., B.A., M.A. (Camb.), Ph.D. (Princ.), F.R.S.C.
Professor of Geophysics — 29 Roxborough St. E.

SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture. On July 1, 1948, the School of Architecture was separated from the Faculty and became an independent School with its own Director and Council.

With the end of the Second World War during the summer of 1945 the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors and the President, the University leased from the Crown part of the large shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in the First Year and 1500 in the Second Year. In the 1947-48 session the enrolment at Ajax consisted of 1200 students in the First Year and 1400 in the Second Year. In the session 1948-49, 600 were registered at Ajax in the First Year and 975 in the Second Year. All other instruction was given in Toronto.

To provide for this self-contained University community at Ajax, there were 446 acres and 111 buildings. The University operated such services as central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence, in 1947-48 there were 1800 students and in 1948-49 there were 900. Student life at Ajax compared favourably with that in Toronto, excellent accommodation being provided for a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

With the completion of the Wallberg Building and the extension of the Mechanical Building, additional accommodation became available on the Queen's Park Campus, and this fact coupled with the decrease in numbers entering each year brought about the closing of Ajax on May 31, 1949.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

GENERAL

1. Candidates for admission in 1952 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

Students from foreign countries must, in addition to providing the necessary equivalent certificates, give evidence of their ability to understand lecture and laboratory courses where the English language is used exclusively, and must demonstrate their ability to use this language in both the spoken and written form, with reasonable facility. Such students are strongly advised to spend a year in Grade XIII of an Ontario Secondary School before seeking admission to this Faculty.

3. Requirements for applicants presenting Ontario certificates.

Secondary School Graduation Diploma

No subjects are definitely prescribed, but the diploma must show credit in English and History, and in four of the optional subjects.

Grade XIII

Standing is required on nine examinations as follows:

English:	Literature	
	Composition	
Mathematics:	Algebra	
	Geometry	
	Trigonometry	
Science:	Chemistry	
	Physics	
One of:	French	*Authors and Composition*
	German	
	Greek	
	Italian	
	Latin	
	Spanish	

To be admitted a candidate must have an average of not less than Second Class Honours on at least five of the nine examinations on which standing is required.

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are advised to select German as one of the admission subjects.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate, generally known as Junior and Senior Matriculation respectively, may be accepted in so far as they meet the admission requirements of the University of Toronto in subjects and percentages and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

QUEBEC

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

MANITOBA, SASKATCHEWAN, ALBERTA

Junior (Grade XI) and Senior (Grade XII) Matriculation certificate.

BRITISH COLUMBIA

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

NEW BRUNSWICK, NEWFOUNDLAND, NOVA SCOTIA, PRINCE EDWARD ISLAND

Junior and Senior Matriculation Certificates of the Common Examining Board or of their respective Departments of Education. Second and Third Year Certificates of Prince of Wales College are also accepted from Prince Edward Island.

GREAT BRITAIN

The Oxford and Cambridge Joint Board School certificate, or equivalent, indicating "Credit" or better standing in English Language and Literature, "Advanced" or "Additional" Mathematics, Physics and Chemistry (not general science), and a foreign language.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 8th to 23rd (Saturdays September 13th and 20th, 9 a.m. to 12 noon), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

Schedule of Fees

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
I-IV	$383	$37	$420	$229	$194
Women					
I-IV	$383	$19	$402	$211	$194

*The Academic Fee includes the following fees:—
Tuition; Library and Laboratory Supply; one Annual Examination; Laboratory Fee; Physical Education; and Degree

†These Incidental Fees include the following fees:—
For men—Hart House; Students' Administrative Council; Athletic; Health Service; Engineering Society; Faculty Athletic Association.
For women—Students' Administrative Council; Athletic; Health Service; Engineering Society.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

SUMMARY OF STUDENTS' EXPENSES

11. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 25.
2. Board and Lodging, per week.................. $15 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8),
Mining Geology (Course 9),
Aeronautical Engineering (Course 10),
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the above courses.

3. The courses extend over four academic years. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering may proceed to post-graduate and professional degrees. The post-graduate degrees are M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and Scholarships for graduate students are available in limited number as shown on page 137. Many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 200 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English, and Engineering and Society; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked

with the graduate courses (page 200), and with the work of the School of Engineering Research (page 29).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the postgraduate degrees, Master of Applied Science, and Doctor of Philosophy, see pages 200 and 201 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 115.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (see subject 690.)

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above-mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 200. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	75, 76	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	284	–	9	–	6
Hydraulics, Elementary	447	1	–	–	–
Least Squares	494	–	–	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Education	640	–	2	–	2
Practical Astronomy	200	1	–	2	–
Practical Experience	690	–	–	–	–
Surveying	714, 716	1	–	1	3
Survey Camp	716	–	–	–	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Cements and Concrete	35, 44	1	3	1	–
Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	297	–	9	–	9
Business	310	–	–	1	–
Construction Surveying	718	–	–	2	–
Control Surveys and Mapping	201	–	–	2	–
Differential Equations	507	1	–	1	–
Engineering Geology	382, 383	2	1	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Machinery	463, 464	2	3	–	–
Modern World History	324	–	–	2	–
Photogrammetry	81	1	–	–	–
Physical Metallurgy	546	2	–	–	–
Political Science	323	2	–	–	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Highway Engineering	217	1	–	1	–
Hydraulics	445, 446	2	3	2	3
Industrial Management	318	1	–	1	–
Mechanics of Materials Lab.	38, 50	–	3	–	6
Modern Political and Economic Trends	325	–	–	1½	–
Municipal Administration and Contracts	216	1	–	1	–
Philosophy of Science	326	2	–	–	–
Practical Experience	690	–	–	–	–
Profession of Engineering	327	–	–	½	–
Sanitary Engineering	214, 215	1	3	1	3
Soil Mechanics and Foundations	40, 299	2	–	1	3
Railway Engineering	218	1	–	1	–
Reinforced Concrete	41, 37	1	3	1	3
Theory of Structures	36, 37	2		2	
Structural Design	43, 299	2	3	1	3
Thesis	730	–	–	–	2

MINING ENGINEERING

(Course 2)

The course in Mining Engineering provides a broad training in the fundamentals of engineering.

The graduate is therefore well prepared to enter any of the many phases of the mineral industry such as the exploration and development of new mineral areas, the mining of mineral deposits by both surface and underground methods, and the milling and metallurgical treatment of the ores and products. The field of the engineer in the mining of precious metals, copper, lead, zinc and nickel in Canada is now augmented by the production of iron, titanium and uranium. Engineering is also increasingly important in the mining and treatment of industrial minerals such as asbestos, limestone and gypsum. Moreover, the expanding world market for mineral products is necessitating the utilization of ore deposits which require the application of the most advanced technological methods.

The course in Mining combines in well balanced proportions, studies in the fields of mathematics, geology, chemistry, structures, mechanics, electricity, metallurgy, and economics and business, together with courses having particular reference to mining. In view of the large proportion of mining graduates employed in production and supervision, the administrative viewpoint is emphasized throughout the course.

With such diversified training, the Mining Engineer is capable of successful participation in all branches of industry and commerce.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 115.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded

Further information appears on page 200 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Applied Mechanics	26	2	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining	165	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	691	–	–	–	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	–	–	6
Chemistry	224	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Problems and Drawing	285	–	6	–	6
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	3
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	–	2	2
Survey Camp	717	1	–	–	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	–	1	6
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Cements and Concrete	35	1	–	1	–
Electrical Machinery	348a	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	298	–	–	–	3
Geological Field Work	409	–	–	–	–
Hydraulics	440, 441	2	1½	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399	2	–	2	–
Mineral Dressing	180, 182	2	–	2	6
Mining	168	1	–	1	–
Mining Laboratory	169	–	3	–	–
Modern World History	324	–	–	2	–
Political Science	323	2	–	–	–
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Structural Geology	397, 398	1	3	1	3
Summer Essays	192	–	2	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geological Field Trips	412	–	1	–	–
Glacial Geology	384	1	–	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Operation and Management	170	2	–	2	–
Mine Ventilation	175, 176	2	3	–	–
Mining Laboratory	172	–	–	–	6
Mining Geology	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Ore Dressing	183, 184	1	6	1	–
Physical Metallurgy	549	1	–	1	–
Practical Experience	691	–	–	–	–
Precambrian Geology	403	2	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	193	–	2	–	–
Philosophy of Science	326	2	–	–	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(Course 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 115.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similiar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 200. The Calendar of the School of Graduate Studies should be consulted for details.

Graduate work leading to an advanced degree in the administrational or business aspects of engineering is also available in the Department of Mechanical Engineering. The thesis subject chosen for this purpose must be in the technological field and intending applicants are advised to obtain the approval of the Head of the Department of Mechanical Engineering before selecting their thesis topics.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	2	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	$1\frac{1}{2}$
Calculus	491	2	–	2	–
Descriptive Geometry	273	1	–	1	–
Dynamics	22	–	–	2	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	286	–	6	–	6
Heat Engines, Elementary	420	–	–	2	–
Mechanical Engineering	461, 480	2	3	2	3
Mechanics of Materials	23, 31	2	3	2	–
Physical Education	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines	465, 466	3	–	3	–
Treatment of Technical Data	449	–	–	3	–

Third Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Business	310	–	–	1	–
Differential Equations	507	1	–	1	–
Electronics	345, 346	2	1½	–	–
Electrical Machines	377, 378	2	1½	2	3
Elementary Structural Engineering	29, 298	1	3	1	3
Heat Engineering	422	2	–	2	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	–	2	3
Machine Design	467, 468	2	6	2	6
Modern World History	324	–	–	2	–
Physical Metallurgy	532	1	–	1	–
Political Science	323	2	–	–	–
Practical Experience	692	–	–	–	–
Theory of Machines B*	466	2	–	–	–

*Session 1952–53 only.

Fourth Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Engine Laboratory	426	–	5	–	5
Heat Power Engineering	424	2	–	2	–
Physical Metallurgy II	547, 548	1	–	1	1½
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	–	1	–
Internal Combustion and Air-Craft Engines	425	1	–	1	–
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Practical Experience	692	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	3	–	–
Thesis	732	–	1	–	1

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 130 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 116.

GRADUATE STUDY

Graduates of this University, or of another University of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students with the necessary qualifications wishing to pursue further studies, may proceed to the M.A.Sc. and PH.D. in the Departments of Engineering Physics, Electrical Engineering, Mechanical Engineering, Aeronautical Engineering, Metallurgical Engineering or, to the M.A. and PH.D. in the Department of Physics.

The requirements and programme will be arranged through the Department concerned.

For further information see page 200 of this Calendar and the Calendar of the School of Graduate Studies.

First Year Subjects Course 5	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	279	–	3	–	3
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Analytical Geometry of Space	506	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits	354, 356	2	1½	2	1½
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	2	–	–	–
Physics Laboratory	655	–	6	–	3
Physical Education	640	–	2	–	2

Third Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Electronics	366, 379	2	–	2	3
Machine Design	471, 472	1	3	1	3
Modern World History	324	–	–	2	–
Physical Laboratory	659	–	3	–	3
Physics of Solids and Fluids	656	1	–	1	–
Political Science	323	2	–	–	–
Thermodynamics and Kinetic Theory	657	3	–	3	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5e Electricity					
Electrical Machines	377, 378	2	3	2	3
Physical Metallurgy	549	1	–	1	–
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Geometrical Optics	660, 661	1	3	1	–
Physical Metallurgy	549	1	–	1	–
Option 5g, Geophysics					
Engineering Geology	382, 383	2	1	2	2
Physical Metallurgy	549	1	–	1	–
Option 5t, Thermodynamics					
Heat Engineering	422, 423	2	3	2	3
Hydraulics	450	1	–	1	–
Physical Metallurgy	549	1	–	1	–
Option 5m, Physical Metallurgy					
Physical Metallurgy	536, 537	2	3	2	3

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5e, Electricity					
Acoustics	97, 98	2	1½	–	–
Atomic Physics	663	3	–	3	–
Circuit Analysis	351	2	–	2	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Engineering Electronics	357, 358	2	1½	1	1½
Transmission at Low and High Frequency	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Ultra-High Frequency Communication	371, 372	–	–	2	1½
Option 5s, X-Rays and Spectroscopy					
Analysis of Materials by Spectrographic and X-Ray Methods	669	1	–	1	–
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	2	–	2	–
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	9	–	9
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5g, Geophysics					
Atomic Physics	663	3	–	3	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 672	2	6	2	6
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Deposits	399	2	–	2	–
Mining Geology (Part)	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	397, 398	1	3	1	3
Thesis Seminar	733	–	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics	89, 90	2	3	2	6
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Photometry and Illumination Design	95, 96	2	3	2	6
Physical Laboratory	674	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5t, Thermodynamics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Machines	377, 378	2	3	2	3
Heat Engineering Laboratory	426	–	6	–	6
Heat Power Engineering	430	1	–	1	–
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	3	1	–
Machine Design	478	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Properties of Living Matter	211, 212	1	2	1	2
Thesis Seminar	733	–	–	1	–
Vibration Engineering	99, 100	1	3	1	3

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5m, Physical Metallurgy					
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–
Operational Methods	364	2	–	2	–
Physical Metallurgy	543, 544	2	3	2	3
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	6	–	6
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(Course 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more us ful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical literature. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 115.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Chemical Engineering is required to submit satisfactory evidence of having had 800 hours' practical experience. (See subject 694).

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 200 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 280	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 280	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	280	–	6	–	3
English	610	2	–	2	–
General Physics	676, 677	3	3	3	3
Physical Education	640	–	2	–	2
Practical Experience	694	–	–	–	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory*	229	–	–	–	–
Calculus	491, 287	2	1½	2	1½
Chemical Laboratory	232	1	9	–	8
Economics	311	2	–	2	–
Electrical Engineering	375, 376	2	3	2	3
Industrial Chemistry	230	3	–	–	3
Inorganic Chemistry	231	2	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234	–	–	3	–
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	694	–	–	–	–

* Not given in Session 1952-53.

THIRD YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Chemical Engineering	242, 243	2	3	2	6
Chemical Theory	240	–	–	2	–
Differential Equations	507	1	–	1	–
Electrochemistry	246, 247	2	$1\frac{1}{2}$	–	–
Heat Engines, Theory	431, 423	1	–	1	3
Industrial Chemistry	241, 249	1	9	3	–
Modern World History	324	–	–	2	–
Organic Chemistry	244, 245	2	–	2	9
Political Science	323	2	–	–	–
Practical Experience	694	–	–	–	–
Public Speaking	319	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	2	2	2	2
Chemical Engineering Thermodynamics	256	2	–	2	–
Chemical Laboratory	251	1	11	–	–
Industrial Chemistry	258	1	–	–	–
Industrial Management	318	1	–	1	–
Machine Design	479, 470	2	–	2	3
Modern Political and Economic Trends	325	–	–	$1\frac{1}{2}$	–
Organic Chemistry	257	1	–	1	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Public Speaking	319	1	–	1	–
Thesis	734	–	7	–	17

ELECTRICAL ENGINEERING

(Course 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 115.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

For the degree of Master of Applied Science at least one year of full-time study is required. From one-half to two-thirds of this time is devoted to lecture subjects in advanced studies chosen according to instructions contained in the Calendar of the School of Graduate Studies. The remainder is devoted to a research project for which a thesis must be submitted.

Further information appears on page 200. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	7
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491, 288	2	3	2	3
Descriptive Geometry	273	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Education	640	–	2	–	2
Practical Experience	695	–	–	–	–

Third Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342, 343	2	4	–	–
Electrical Problems	335	–	2	–	4
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Application in Electricity Engineering	336	–	–	3	–
Modern World History	324	–	–	2	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	2	–	–	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	4½	–	1½
Electrical Problems and Seminar	359	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	1½	1	1½
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	2	–	2	–
And one of the following groups of subjects:					
Group A					
Acoustics	82, 83	–	–	2	1½
Communications II	362, 363	–	–	3	3
Ultra-High Frequency Communications	371, 372	–	–	2	1½
Group B					
Alternating-Current Machinery II	369, 370	–	–	2	1½
Electrical Design	373, 374	–	–	2	2
Illumination	93, 94	–	–	2	3

METALLURGICAL ENGINEERING

(Course 8)

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

Both physical and extractive metallurgy are based upon the sciences of chemistry and physics. It is believed that a wider knowledge of the basic sciences will bring to the student a readier appreciation of the technical problems with which he will be later confronted and a greater facility in their solution. To achieve this end, greater emphasis is placed upon physics and chemistry in the earlier years of the course. It follows that this course will be of greater value to students who have obtained a good standing in mathematics and science. In addition to instruction in extractive and physical metallurgy, engineering subjects are provided to give a general knowledge of mechanics of materials, machine design, etc. The course includes the non-technical subjects, such as Economics and English, which are common to all courses in the Faculty.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical Metallurgy courses cover the structure and properties of alloys, including microscopic, x-ray and mechanical methods of investigation.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 115.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 200 and in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Applied Mechanics	24	2	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	280	–	3	–	6
English	610	2	–	2	–
General Physics	676, 677	3	3	3	3
Physical Education	640	–	2	–	2

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225,228	1	–	1	6
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Inorganic Chemistry	231	2	–	1	–
Mechanics of Materials	23,31	2	3	2	–
Metallurgy	530	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2
Physics Laboratory	655	–	3	–	6

Third Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Differential Equations	507	1	–	1	–
Electrical Machinery	348a	2	–	–	–
Electrochemistry	246, 247	1½	3	–	–
Metallurgical Problems Laboratory	531	–	2	–	2
Metallurgical Theory	239	2	–	2	–
Mineral Dressing	180	2	–	2	–
Modern World History	324	–	–	2	–
Political Science	323	2	–	–	–
Principles of Extractive Metallurgy	534, 535	2	6	1	6
Principles of Physical Metallurgy	536, 537	2	3	2	3

Fourth Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgical Theory	550	1	–	1	–
Metallurgical Problems Laboratory	540	–	2	–	2
Metallurgy Laboratory	541	–	6	–	–
Modern Political and Economic Trends	325	–	–	1½	–
Non-Ferrous Production Metallurgy	542	2	–	2	–
Ore Dressing	182, 183	1	–	1	6
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	543, 544	2	6	2	3
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	736	–	4	–	7

CERAMIC ENGINEERING

(COURSE 8a)

The Course in Ceramic Engineering has been discontinued but instruction will be given until those students now enrolled in the course have a reasonable opportunity to graduate.

THIRD YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	162	–	1½	–	–
Business	310	–	–	1	–
Ceramic Minerals and Calculations	560	4	–	2	–
Ceramics	562	–	–	2	–
Chemical Theory	240	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	298	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	1½
Heavy Clay Products Laboratory	561	–	3	–	6
Hydraulics	440, 441	2	3	–	–
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Dressing	180	2	–	2	–
Modern World History	324	–	–	2	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	2	–	–	–

Fourth Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Glass and Enamels	566	1	–	1	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Mineral Deposits	399	2	–	2	–
Mineral Dressing Laboratory	182	–	–	–	6
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Refractories and Ceramic Bodies	565	2	–	1	–
Thesis	737	–	13	–	13
Whitewares and Enamels Laboratory	568	–	6	–	6

MINING GEOLOGY

(Course 9)

The course in Mining Geology is designed for those who wish to enter the field of applied geology. It provides a training in the fundamentals of the geological sciences, and a graduate in this course will be suitably trained to enter any of the branches of geology such as mining geology, engineering geology, petroleum geology, or field and exploration work for mining and oil companies.

The first year of the course in Mining Geology is identical with that in Mining Engineering. In the remaining years, while the emphasis is on geology, instruction is also given in the allied engineering fields. In this way the student in Geology is given a basic engineering training and an understanding of the extractive industries of mining and metallurgy.

The geological courses in the first and second years cover the general fields of physical geology, historical and stratigraphic geology, and minerals and rocks. The third and fourth years are spent in concentrated work on specialized topics as ore deposits, petroleum and structural geology, palaeontology, microscopic study of rocks and ores, Precambrian geology, glacial geology, mining geology, geology of Canada, and geophysics.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 115.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a M.A.Sc. or Ph.D.

Work for such degrees will include the preparation of a thesis on an approved subject, together with the study of advanced courses.

Further information appears on page 200. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 275	2	1	2	1
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	3
English	610	2	–	2	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining	165	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	696	–	–	–	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	–	–	6
Chemistry	224	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Problems and Drawing	290	–	3	–	3
Geological Field Trips	410	–	–	–	–
Heat Engines, Elementary	420	1	–	–	–
Historical and Stratigraphical Geology	393, 394	2	2	2	2
Mechanics of Materials	23, 31	2	–	2	1
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Education	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	–	2	2
Survey Camp	717	–	–	–	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Elementary Geochemistry	385	2	–	2	–
Geological Field Trips	411	–	–	–	–
Geological Field Work	409	–	–	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399, 400	2	3	2	3
Mineral Dressing	186	2	–	–	–
Mining	168	1	–	1	–
Modern World History	324	–	–	2	–
Palaeontology	395, 396	2	2	2	2
Petrology	391, 392	2	2	2	2
Political Science	323	2	–	–	–
Practical Experience	696	–	–	–	–
Structural Geology	397, 398	1	3	1	3
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mineralogy	388	–	2	–	2
Engineering Economics	313	–	–	1	–
Geology of Canada	401	1	–	1	–
Geological Field Trips	412, 413, 414	–	–	–	–
Geophysics	671, 673	1	3	1	3
Glacial Geology	384	1	–	1	–
Mine Operation and Management	170	2	–	2	–
Mining Laboratory	172	–	–	–	6
Mining Geology	405, 406	–	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Petroleum Geology	407, 408	2	–	2	3
Practical Experience	696	–	–	–	–
Precambrian Geology	403, 404	2	2	–	2
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Thesis	738	–	6	–	–

AERONAUTICAL ENGINEERING

(Course 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 130 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 116.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 200. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aeronautics	1	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	274	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Engineering Problems and Drawing	291	–	3	–	3
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Education	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	2	–	2	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mechanics	27	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	2	3	1	3
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Electrical Engineering	375, 376	2	3	2	3
Heat Engines, Theory	420, 421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	3	2	3
Modern World History	324	–	–	2	–
Political Science	323	2	–	–	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Propulsion	11	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Gas Dynamics	30	2	–	2	–
Modern Political and Economic Trends	325	–	–	$1\frac{1}{2}$	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(Course 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderantly engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Calculus 491, page 115.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course (see Practical Experience, 698, page 126).

First Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	2	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	1½
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	273	1	–	1	–
Dynamics	22	–	–	2	–
Economics	311	2	–	3	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	288	–	6	–	6
Heat Engines, Elementary	420	–	–	2	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	532	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	698	–	–	–	–

Third Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	1	2	1
Applied Economics	308	2	–	2	2
Differential Equations	507	1	–	1	–
Electronics	345, 346	2	1½	–	–
Elementary Structural Engineering	29, 298	1	6	1	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	2	1	1	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	–	–	2	–
Political Science	323	2	–	–	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

Fourth Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345a, 346a	2	3	–	–
Business Policy	309	3	2	3	2
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Illumination and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy II	547, 548	1	–	1	1½
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	–	2	3
Thesis	740	–	1	–	1

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 33.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, II Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text book: Technical Aerodynamics—K. D. Wood.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Two dimensional airfoil theory; finite wing theory; performance calculation; drag and boundary layers; static stability and control.

Text books: Airfoil and Airscrew Theory—Glauert. Airplane Performance, Stability and Control—Perkins & Hage. Foundations of Aerodynamics—Kuethe & Schetzer.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

Half of the time allotted is spent in the drafting room working problems on airfoil theory, performance, stability, and control. The other half is spent in the wind-tunnel laboratory, where experiments are conducted to illustrate the principles of fluid mechanics, and to demonstrate typical aerodynamic data.

Text book: Wind Tunnel Testing—Pope.

5. Airplane Design and Layout. T. R. Loudon, W. H. Jackson, W. Czerwinski, R. D. Hiscocks, D. G. Allan.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

The preliminary design of light aircraft is discussed in these lectures. It is intended to give the student a grasp of the principles of balance and load distribution necessary for the design of the various components. About three quarters of these lectures are given in a class room, the remainder being given in the laboratory where practical work is carried out.

Text books: Civil Airworthiness Requirements (British). Civil Aeronautics Manual 04 (U.S.).

6. Airplane Design and Layout Laboratory. T. R. Loudon, W. H. Jackson, W. Czerwinski, D. G. Allan.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

This course is divided roughly into three periods devoted respectively to the preliminary design of light aircraft, fitting design and layout and final design of a light aircraft project which is actually constructed under the supervision of skilled aircraft mechanics. The course gives the practical application of the lectures in course 5.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Analysis and Design of Airplane Structures—Bruhn. Aircraft Structures—Peery. Airplane Structures—Niles and Newell.

8. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 3 hrs. laboratory per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. Some of this work is taken in conjunction with light aircraft design in laboratory work described in subject 6.

9. Airplane Stress Analysis. T. R. Loudon, D. G. Allan.

Course 10, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

These lectures serve as an introductory course to the advanced structural analysis course used in aircraft design given in the fourth year. An introductory course is also given on the methods used in determining the balance of an aircraft for the various cases laid down by I.C.A.O. and other governing bodies.

Text books: Analysis and Design of Airplane Structures—Bruhn. Fundamentals of Aircraft Structures—Barton. I.C.A.O.—Airworthiness Manual. A.R.B.—Manual (Section D). C.A.M.—04 (U.S.).

10. Airplane Stress Analysis Laboratory. D. G. Allan.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aircraft Propulsion. R. B. McIntyre.

Course 10, IV Year; 1 hr. lecture per week, both terms.

This course of lectures deals with theory of the propeller. The principles of operation of the reciprocating engine, turbo jet, gas turbine and rocket are explained.

12. Aircraft Layout. W. Jackson, R. D. Hiscocks.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 3, 7, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures.

Text book: Applied Statics—Loudon.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 3, 7, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith, F. C. Hooper, J. M. F. Vickers.

Courses 1 and 7, II Year; 1 hr. lecture per week, both terms.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Reference book: Mechanics—Den Hartog.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins and staff in Civil Engineering.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

For Course 10, the work is carried further in order to cover some more advanced problems dealing with plate girders.

Text book: Resistance of Materials—Seely.

24. Applied Mechanics. T. R. Loudon, B. Etkin, D. G. Allan.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts; statics in the fall term; and dynamics in the spring term.

Statics: Principles of plane statics and application to a variety of problems including elementary framed structures and simple beams.

Dynamics: Principles of dynamics, and application to plane motion of particles, and plane translation of rigid bodies.

Text books: Applied Statics—Loudon. Vectorial Mechanics—Brand.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vector analysis; vector treatment of kinematics; Coriolis' acceleration; general plane motion of rigid bodies; gyroscopes; dimensional analysis.

Text book: Vectorial Mechanics—Brand.

26. Applied Mechanics. T. R. Loudon, B. Etkin, D. G. Allan.

Courses 2, 6, 8 and 9, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts; statics in the fall term, and dynamics in the spring term.

Statics. Principles of plane statics and application to a variety of problems including elementary framed structures and simple beams.

Dynamics. Principles of dynamics, and application to motion of particles on straight and curved paths—work, energy, power, impulse and momentum. Plane translation of rigid bodies.

Text books: Applied Statics—Loudon. Principles of Physics, Mechanics—Sears.

27. Advanced Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Continuation of course 25, dealing with rotating frames of reference; Euler's Equations for rigid bodies; oscillating systems of one and more degrees of freedom; Lagrange's Equations.

Text books: Vectorial Mechanics—Brand. Principles of Mechanics—Synge & Griffith.

28. Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young and Morrison. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. C. F. Morrison, M. W. Huggins.

Courses 2, 3, 8a, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

30. Gas Dynamics. G. N. Patterson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods. Some instruction will be given at the Institute of Aerophysics.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9, and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Vector operators; classical equations for perfect fluids; velocity potential; stream function; complex potential; Bernoulli's equation for incompressible and compressible flow. Verticity, circulation, lift. Poiseuille flow.

Text book: Fluid Dynamics—Streeter. Airfoil and Airscrew Theory—Glauert.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Courses 1 and 2, III year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool Elementary Structural Engineering—Urquhart and O'Rourke. Reference Book: Basic Reinforced Concrete Design—Lange.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

37. Theory of Structures and Reinforced Concrete. Staff in Civil Engineering.

Course 1, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out in the laboratory following the lecture courses 36 and 41.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

40. Soil Mechanics and Foundations. T. R. Loudon, W. L. Sagar.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

The design of foundations, retaining walls and dams is discussed in detail preliminary to working out problems in the laboratory.

Reference books: Foundation of Structures—Dunham. Soil Mechanics in Engineering Practice—Terzaghi and Peck. Soil Mechanics, Foundations, and Earth Structures—Tschebotarioff.

Proceedings, Second International Conference on Soil Mechanics. Design of Concrete Structure—Urquhart and O'Rourke.

41. Reinforced Concrete. M. W. Huggins.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the rigid arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Text book: Basic Reinforced Concrete Design—Large.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

43. Structural Design. M. W. Huggins.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Steel Mill Buildings—Ketchum. Structural Problems—Young and Morrison. Theory of Modern Steel Structures—Grinter.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 3 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Course 3, IV Year; 2 hrs. lectures per week, first term.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson. Structural Problems—Young and Morrison.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Specifications—Dept. of Highways, Ontario. A.S.T.M.; C.S.A.; A.A.S.H.O. Specifications. Soil Testing for Engineers—Lambe.

APPLIED PHYSICS

70. Applied Physics. J. T. N. Atkinson, F. B. Friend.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics—Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. J. T. N. Atkinson, F. B. Friend.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

75. Applied Physics. J. T. N. Atkinson, F. B. Friend.

Course 1, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. J. T. N. Atkinson, F. B. Friend.

Course 1, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 75.

81. Photogrammetry. K. B. Jackson.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Acoustics. V. L. Henderson.

Course 7, IV Year; 2 hrs. lectures per week, second term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference book: Elements of Acoustical Engineering—Olson.

83. Acoustics Laboratory. V. L. Henderson.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Supplementing course 82.

89. Architectural Acoustics. V. L. Henderson.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

Reference book: Acoustical Designing in Architecture—Knudsen and Harris.

90. Architectural Acoustics Laboratory. V. L. Henderson.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Supplementing subject 89.

91. Illumination and Acoustics. V. L. Henderson, J. R. Bird.

Course 11, IV Year; 1 hr. lecture per week, both terms.

The production of light and the engineering principles underlying its utilization.

The generation and control of sound.

Reference book: Less Noise Better Hearing—Sabine.

92. Illumination and Acoustics. V. L. Henderson, J. R. Bird.

Course 11, IV Year; 1½ hrs. laboratory per week, both terms.

A laboratory course supplementing course 91.

93. Illumination. J. R. Bird.

Course 7, IV Year; 2 hrs. lecture per week, second term.

Illuminating Engineering dealing with the nature, measurement, and production of light and related radiations.

Theory of human vision; the design and application of lighting equipment for visual efficiency and comfort. Fundamentals of power supply.

94. Illumination Laboratory. J. R. Bird.

Course 7, IV Year; 3 hrs. per week, second term.

Supplementing subject 93.

95. Photometry and Illumination Design. J. R. Bird.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. J. R. Bird.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

Acoustics of electrical sound systems; including sound waves,

hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference book: Elements of Acoustical Engineering—Olson.

98. Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.

Course 5e, IV Year; $1\frac{1}{2}$ hrs. laboratory per week, first term.

Supplementing subject 97.

99. Vibration Engineering. V. L. Henderson.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson, P. A. Macpherson.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ASSAYING, MINING AND ORE DRESSING

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved. but also upon the errors inherent in operators as well as in methods,

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich. The Sampling and Assay of the Precious Metals—E. A. Smith.

161. Assaying Laboratory. M. Hewer.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

The determination of precious metals. Scorification, crucible and combination wet and dry methods of assaying ores both simple and complex; milling and metallurgical products including cyanide solutions, cyanide precipitates and gold bullion. Attention is also given to the sampling and assay of ores containing radio-active minerals.

162. Assaying Laboratory. M. Hewer.

Course 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lectures periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for ceramic engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining. The Staff in Mining Engineering.

Courses 2 and 9, I Year; 2 hrs. per week, second term.

A combined laboratory and lecture course. It is an introduction to the principles of mining and sampling calculations.

166. Mining. R. E. Barrett.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

A course of lectures relating to underground and surface mining methods, rock boring machinery and practice.

168. Mining. R. E. Barrett.

Courses 2 and 9, III Year; 1 hr. lecture per week, both terms.

Methods of mine development by mine adits, shafts, drifts and crosscuts; stoping methods, loading, and underground transportation.

169. Mining Laboratory. S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, first term.

Special mining problems are given relating to sampling, diamond drilling, stope measurements, the factors affecting the angle of repose of broken materials and the behaviour of such materials when in motion. To develop the individual students' initiative, some special survey problems are worked in the laboratory.

170. Mine Operation and Management. R. E. Barrett.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, both terms.

Lectures on advanced mining practice, deep mining problems, mine mechanization, underground crushing, hoisting and communications, mine safety and hygiene, mine plant and layout, mining company structure and financing, cost statements, incentive wage plans, and various aspects of labor relations such as labor legislation, unions and collective bargaining.

172. Mining Laboratory. R. E. Barrett.

Courses 2 and 9, IV Year; 6 hrs. laboratory per week, second term.

Problems in mine layout involving shaft location and size; mine development; choice of stoping methods, mining rate, and mine equipment; time and cost schedules; ore reserve calculations.

175. Mine Ventilation and Allied Problems. G. R. Lord.

Course 2, IV Year; 2 hrs. lectures per week, first term.

Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

176. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.

Course 2, IV Year; 3 hrs. laboratory per week, first term.

Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

180. Mineral Dressing. S. E. Wolfe.
Courses 2, 8, and 8a, III Year; 2 hrs. lectures per week, both terms.
The course deals with the economics of, the theoretical principles and their practical application in, the treatment of ores and mineral aggregates. These involve the processes of crushing, grinding, sizing and classification; gravity, magnetic, and electrostatic separation; and an introduction to froth flotation. In addition, ancillary processes are studied. These include flocculation, sedimentation, filtration, drying of mineral products and the precipitation and collection of dust and fume.

182. Mineral Dressing Laboratory. S. E. Wolfe.
Course 2, III Year; Courses 8 and 8a, IV Year; 6 hrs. laboratory per week, second term.
This work is coordinated with the lecture course 180. Studies are made of crushing machinery, the principles of crushing and grading of rock products, screen analysis, and the sampling of broken material and mill products. Certain tests with gravity concentrating machines are made and an introduction to the technique of flotation test work is given.

183. Ore Dressing. S. E. Wolfe.
Course 2 and 8, IV Year; 1 hr. lecture per week, both terms
The subjects covered are extensions of those in 180 and 182; cyanidation, flotation processes and technique, the current practice at milling plants, and problems associated with milling.

184. Ore Dressing Laboratory. S. E. Wolfe.
Course 2, IV Year; 6 continuous hours per week, first term.
Advanced work coordinated with lecture course 183 and pertaining to ore dressing appliances, the handling in bulk of finely divided solids, the selective flotation of sulphides, ore testing, and pilot plant mill runs.

186. Mineral Dressing. S. E. Wolfe.
Course 9, III Year; 2 hrs. lectures per week, first term.
This abridged course deals with current practice and fundamental principles in the field of mineral beneficiation.

190. Theory of Measurements. M. Hewer.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
Engineering work requires the practical utilization of measurements which have varying degrees of precision. This course deals with the philosophy underlying the causes of errors, their effect and relative importance upon computed results, and the interpretation of numbers to represent measurements. The use of charts and

graphs to illustrate certain measurements and the derivation of empirical equations from these charts is also considered.

192. Summer Essay. M. Hewer.

Course 2, III Year:

An essay, or report, written on a mining subject, preferably some phase of work with which the student is associated during summer employment. Subsequently, each student will deliver a talk to his class on the subject chosen. Thus, training is afforded in both technical writing and public speaking. Students are briefed in advance concerning requirements of this course.

193. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. J. W. Melson, H. L. Macklin.

Course 1, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

The derivation of formulae and their application to the solution of spherical triangles and practical problems. Practical determination of time, latitude and azimuth by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Text books: Nautical Almanac for current year and printed lecture notes.

201. Control Surveys and Mapping. O. J. Marshall.

Course 1, III Year; 2 hrs. lectures per week, second term.

Principles and Methods of control surveys involving triangulation, traverse, and levelling of various degrees of precision; elementary geodesy and map projections.

Text book: Advanced Surveying and Mapping—Whitmore.

Reference books: Higher Surveying—Breed and Hosmer, Vol. II, 6th Ed. Theory and Practice Surveying—Tracy.

BOTANY

211. Properties of Living Matter. D. H. Hamly.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

A study of the cell, its variations, constituents, and mechanisms, as a means of interpreting biological phenomena.

212. Properties of Living Matter. D. H. Hamly.

Course 5t, IV Year; 2 hrs. laboratory per week, both terms.

A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, W. M. Walkinshaw.

Course 1, IV Year; 3 hrs. per week, both terms.

Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration and Contracts. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 299.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, also forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

217. Highway Engineering. W. L. Sagar.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Principles governing the location, design, and construction of highways and airports.

Reference books: Highway Design and Construction — Bruce. The Highway Improvement Act — Ontario

218. Railway Engineering. W. M. Treadgold.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Principles governing location, design and construction of railways.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. C. P. Brockett, W. F. Graydon.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, W. F. Graydon.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, I Year; 3 hrs. laboratory per week, both terms.

A laboratory course illustrating the fundamental laws of chemistry as dealt with in the lecture course, and providing an introduction to chemical analytical methods.

224. Chemistry. J. G. Breckenridge.

Courses 2 and 9, II Year; 2 hrs. lectures per week, first term.

An introduction to modern theories of molecular structure, and to organic chemistry.

225. Analytical Chemistry. L. J. Rogers.

Course 8, II Year; Course 2, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis; select volumetric and gravimetric methods; technical analysis.

226. Engineering Chemistry. The Staff in Chemical Engineering.

Courses 1, 3, 7, and 11, II Year; 2 hrs. lectures per week, first term.

Water-treatment, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. W. F. Graydon.

Courses 2 and 9, II Year; 6 hrs. laboratory per week, second term.

Volumetric and gravimetric analysis.

228. Analytical Chemistry Laboratory. L. J. Rogers.

Course 8, II Year; 6 hrs. laboratory per week, second term.

Gravimetric and volumetric methods, acidimetry and alkalimetry.

Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Analytical Chemistry Laboratory. W. F. Graydon.

Course 6, II Year.

This course commences on the Wednesday following the first Monday in September, and continues until the opening of the Fall Term. All the working time will be spent on systematic quantitative inorganic analysis.

Text book: Textbook of Inorganic Analysis—Kolthoff and Sandell.

230. Industrial Chemistry. E. A. Smith.

Course 6, II Year; 3 hrs. lectures per week, first term: 3 hrs. laboratory per week, second term.

Manufacture of acids, alkalis, and inorganic chemicals; water-treatment, corrosion, explosives. The second term work consists of calculations dealing with certain industrial chemical problems.

231. Inorganic Chemistry. C. P. Brockett.

Courses 6 and 8, II Year; 2 hrs. lectures per week, first term: 1 hr. lecture per week, second term.

The constitution of matter and classification of the elements: systematic inorganic chemistry.

In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Mellor's Modern Inorganic Chemistry, (1951 Edition), Chapters 8, 17-25, 35.

232. Chemical Laboratory. E. A. Smith, W. F. Graydon.
Course 6, II Year; 1 hr. lecture and 9 hrs. laboratory per week, first term; 8 hrs. laboratory per week, second term.
A continuation of subject 229, followed by methods of technical analysis, selected analytical procedures, and instruction in glass-blowing.

233. Industrial Chemistry. E. A. Smith.
Course 11, II Year; 1 hr. lecture per week, both terms.
Manufacture of acids, alkalis, inorganic chemicals.

234. Organic Chemistry. J. G. Breckenridge.
Course 6, II Year; 3 hrs. lectures per week, second term.
An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

236. Physical Chemistry. D. J. LeRoy, R. L. McIntosh.
Courses 2, 6 and 8, II Year; 2 hrs. lectures per week, both terms.
Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.
Text book: Principles of Phase Equilibria—Wetmore and LeRoy.

237. Analytical Chemistry Laboratory. L. J. Rogers.
Course 2, III Year; 6 hrs. laboratory per week, second term.
Technical analysis of ores and furnace products; wet assaying.

240. Chemical Theory. R. R. McLaughlin, W. F. Graydon.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term.
A discussion of the principles of adsorption and colloid chemistry; chemical equilibria.

241. Industrial Chemistry. E. A. Smith.
Course 6, III Year; 3 hrs. lectures per week, second term.
Chemical process industries, including petroleum, soap, sugar, pulp and paper, and fermentation industries. In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Chemical Process Industries—Shreve: Chapters 29, 30, 31, 33, 34, 37.

242. Chemical Engineering. W. G. MacElhinney, W. C. Macdonald.
Course 6, III Year; 2 hrs. lectures per week, both terms: 3 hrs. laboratory per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other unit operations. The laboratory work in the first term consists of calculations on chemical engineering problems. In preparation for this course, students will be expected to have read and to be thoroughly familiar with recommended chapters from the following texts: Chemical Machinery—Riegel; Unit Operations—Brown.

243. Chemical Engineering Laboratory. W. G. MacElhinney.
Course 6, III Year; 6 hrs. laboratory per week, second term.
Experiments on unit operations to accompany subject 242.

244. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234.

245. Organic Chemistry Laboratory. R. M. Husband.
Course 6, III; 9 hrs. laboratory per week, second term.
A laboratory course accompanying subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 2 hrs. lectures per week, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Courses 6 and 8, III Year; 18 hrs., first term.
Quantitative measurements to accompany subject 246.

249. Industrial Chemistry Laboratory. E. A. Smith, W. F. Graydon.
Course 6, III Year; 1 hr. lecture and 9 hrs. laboratory per week, first term.
A continuation of subject 232.

250. Organic Chemistry. J. G. Breckenridge.
Course 5, II Year; 2 hrs. lectures per week, first term.
General reactions and methods of synthesis of carbon compounds.
Text book: Organic Chemistry. A Brief Course—Brewster.

251. Chemical Laboratory. Staff in Chemical Engineering.
Course 6, IV Year; 1 hr. lecture and 11 hrs. laboratory per week, first term.
A continuation of subject 243, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, organic, and analytical chemistry.

253. Chemical Engineering. Staff in Chemical Engineering.
Course 6, IV Year; 2 hrs. lectures and 2 hrs. laboratory per week, both terms.
A continuation of subject 242; the laboratory periods consist of calculations on selected chemical engineering problems and instruction in the use of graphical methods.

256. Chemical Engineering Thermodynamics. W. C. Macdonald, W. F. Graydon.
Course 6, IV Year; 2 hrs. lectures per week, both terms.
The application of thermodynamics to problems in the field of chemical engineering.

257. Organic Chemistry. R. R. McLaughlin.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subjects 234 and 244.

258. Industrial Chemistry. E. A. Smith, R. M. Husband.
Course 6, IV Year; 1 hr. lecture per week, first term.
IV Year Forestry; 1 hr. lecture per week, both terms.
Pulp and paper, and cellulose industries.
In preparation for this course, students will be expected to have read and to be thoroughly familiar with the following: Chemical Process Industries—Shreve: Chapters 33, 34.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

269. Descriptive Geometry. A. Wardell.
Courses 1, 2, 6, 7, 8 and 9, I Year; 1 hr. lecture per week, both terms.
These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines and planes.
Text book: Descriptive Geometry—Watts and Rule.

270. Descriptive Geometry. A. Wardell.
Courses 3 and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines, planes and curved surfaces. Problems of shades, shadows and perspective are also dealt with.
Text book: Descriptive Geometry—Watts and Rule.

271. Descriptive Geometry. A. Wardell.
Courses 5 and 10, I Year; 1 hr. lecture per week, both terms.
Course 269 with the addition of some work in curved surfaces.
Text book: Descriptive Geometry—Watts and Rule.

272. Descriptive Geometry. A. Wardell.
Course 1, II Year; 1 hr. lecture per week, both terms.
A continuation of lecture course 269. Problems of curved surfaces, shades, shadows and perspective are discussed: also, an introduction is given to the principles of projection used in map making.
Text book: Descriptive Geometry—Watts and Rule.

273. Descriptive Geometry. A. Wardell.
Courses 3, 7 and 11, II Year; 1 hr. lecture per week, both terms.
A continuation of lecture course 269. Problems of curved surfaces, shades, shadows and perspective are discussed.
Text book: Descriptive Geometry—Watts and Rule.

274. Descriptive Geometry. A. Wardell.
Course 10, II Year; 1 hr. lecture per week, both terms.
A continuation of lecture course 271. Problems of curved surfaces, shades, shadows and perspective are discussed with attention to problems of special interest to students in aeronautical engineering.
Text book: Descriptive Geometry—Watts and Rule.

ENGINEERING PROBLEMS AND DRAWING

The courses in Engineering Problems and Drawing consist premarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems in the First and Second Years deal with the fundamental engineering studies—mathematics, applied mechanics, descriptive geometry, the plotting of surveys that have been made by the student in the field, theory of machines, while in the Third and Fourth Years, the problems deal mainly with design.

275. Engineering Problems and Drawing. A. Wardell.
Courses 1, 3 and 11, I Year; 11 hrs. per week, both terms.
Course 2, I Year; 6 hrs. per week, both terms.
Course 7, I Year; 11 hrs. per week first term, 12 hrs. per week second term.
Course 9, I Year; 8 hrs. per week, first term, 5 hrs. per week, second term.
Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus.) Plotting or original surveys.
Text book: Engineering Drawing—French.

279. Engineering Problems and Drawing. A. Wardell.
Course 5, I Year; 3 hrs. per week, both terms.
Course 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Plotting of original surveys.
Text book: Engineering Drawing—French.

280. Engineering Problems and Drawing. A. Wardell.
Course 6, I Year; 9 hrs. per week, first term; 6 hrs. per week, second term.
Course 8, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Drawing and lettering. The solving of problems in descriptive geometry, applied mechanics, and mathematics.
Text book: Engineering Drawing—French

284. Engineering Problems and Drawing. A. Wardell.
Course 1, II Year: 9 hrs. per week, first term; 6 hrs. per week, second term.
Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials. Problems in mathematics (calculus).

285. Engineering Problems and Drawing. A. Wardell.
Course 2, II Year; 6 hrs. per week, both terms.
Problems in descriptive geometry, mechanics of materials. Flow sheets. Plotting of original surveys.

286. Engineering Problems and Drawing. A. Wardell.
Course 3, II Year; 6 hrs. per week, both terms.
Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of machines. Problems in mathematics (calculus).

287. Engineering Problems and Drawing. A. Wardell.
Course 6, II Year; 3 hrs. per week, alternate weeks, both terms.
Problems in mathematics.

288. Engineering Problems and Drawing. A. Wardell.
Course 7, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.
Course 11, II Year; 6 hrs. per week both terms.
Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials. Problems in mathematics (calculus).

289. Engineering Problems and Drawing. A. Wardell.
Course 8, II Year; 3 hrs. per week, both terms.
Problems in descriptive geometry, mechanics of materials and mathematics.

290. Engineering Problems and Drawing. A. Wardell.
Course 9, II Year; 3 hrs. per week, both terms.
Problems in descriptive geometry and mechanics of materials.

291. Engineering Problems and Drawing. A. Wardell.
Course 10, II Year; 3 hrs. per week, both terms.
Problems in descriptive geometry— intersection of curved surfaces. Problems in mechanics of materials.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 1, III Year; 9 hrs. per week, both terms.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses.

298. Engineering Problems and Drawing. W. B. Dunbar.
Course 2, III Year; 3 hrs. per week, second term.
Course 3, III Year; 3 hrs. per week, both terms.
Course 8a, III Year; 3 hrs. per week, both terms.
Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week, second term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar.
Course 1, IV Year; 3 hrs. per week, both terms.
Problems based on lecture course 43.

300. Structural Design Drawing. W. B. Dunbar.
Course 3, IV Year; 3 hrs. per week, first term.
Course 11, IV Year; 3 hrs. per week, second term.
Problems in determination of stresses in, and design of mill building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. F. N. Beard.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.
An introduction to the theory and practice of Accounting, the procedures followed in the preparation of financial statements, and the use of Accounting as a means of control.

307. Statistics. D. Black.
Course 11, III Year; 2 hrs. lectures per week, both terms.
An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. S. Stykolt.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.
A survey of contemporary economic institutions and problems and the application of economic theory to income determination, money and banking,i ndustrial fluctuations, fiscal policy and labour problems.

309. Business Policy. A. W. Currie, G. F. Bain.
Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.
Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.
Courses 1, 2, 3, 7, 8a, and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. S. Triantis.

All courses, II Year; 2 hrs. lectures per week, both terms.

An Introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An introduction to Political Economy—Bladen.

313. Engineering Economics. J. W. Church.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management. R. E. Barrett.

Course 8, IV Year, 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of management, including labour relations, plant organizing, maintenance and safety.

318. Industrial Management. E. A. Allcut.

Courses 1, 3, 6, 7, and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.

Course 6, III Year; Course 6, IV Year; 1 hr. per week, both terms.

321. Industrial Management A. E. A. Allcut, J. W. Church.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, first term; 1 hr. lecture and 1 hr. laboratory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

323. Introduction to Political Science. K. D. McRae.

All courses, III Year; 2 hrs. lectures per week, first term.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. H. I. Nelson.

All courses, III Year; 2 hrs. lectures per week, second term.

An outline of the chief trends and developments in selected key areas during the 19th and 20th centuries.

325. Modern Political and Economic Trends. C. F. Owen.

All courses, IV Year; 18 lectures, second term.

A study of the theory and practice of modern economic and political trends.

326. Philosophy of Science. Marcus Long.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 2 hrs. lectures per week, first term.

The relation between Science and Philosophy; an examination of the presuppositions of science and its basic concepts; alternative accounts of the nature of the universe with their implications for social and moral behaviour.

327. The Profession of Engineering. G. R. Lord.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering.

328. Industrial Management B. C. E. Olive.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service, etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. Staff in Electrical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference book: Introduction to Electrical Engineering—Ward.

332. Electricity. H. A. Courtice.

Courses 3 and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculations of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Basic Electrical Measurements—Stout.

333. Electrical Fundamentals. J. E. Reid.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

Reference book: Electric and Magnetic Fields—Boast.

334. Electrical Laboratory.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

335. Electrical Problems.

Course 7, III Year; 2 hrs. per week, first term; 4 hrs. per week, second term.

Problems associated with subjects 336, 337, 339, 341 are assigned and worked out under staff supervision. As practice in public speaking, one hour per week in the second term is used for short talks by students on subjects of their own choosing. Comments and suggestions are made by staff members in charge.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair.

Course 7, III Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the application of electronics to electrical engineering.

Reference book: Electromic Engineering Principles—Ryder.

339. Direct Current Machines. G. F. Tracy, D. N. Cass-Beggs, R. Scott.

Course 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering. Vol. I—Dawes. Electrical Circuits and Machinery, Vol I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of

Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. G. F. Tracy and staff.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. J. E. Reid.

Course 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, and other electrical equipment.

343. Electrical Design Laboratory. L. S. Lauchland.

Course 7, III Year; 4 hrs. laboratory per week, first term.

To accompany subject 342.

344. Electrical Laboratory.

Course 7, III Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Electronics. G. F. Tracy and Staff.

Courses 3 and 11, III Year; 2 hrs. lectures per week, first term.

Thermionic emission, vacuum-tube characteristics and applications, amplifiers, gaseous-tube characteristics and applications.

Text book: Basic Electrical Engineering—Fitzgerald.

345a. (formerly 345) Alternating-Current Machinery (1952-53 only). G. F. Tracy and Staff.

Course 11, IV Year; 2 hrs. lectures per week, first term.

Characteristics of alternating-current machines and the various methods of control.

346. Electronics Laboratory.

Courses 3 and 11, III Year; 3 hrs. laboratory alternate weeks, first term.

Laboratory exercise to accompany subject 345.

346a. (formerly 346) Electrical Laboratory (1952-53 only).

Course 11, IV Year; 3 hrs. laboratory per week, first term.

347. Electric Circuits and Machines. G. F. Tracy and Staff.

Courses 1, 2 and 9, II Year; 1 hr. lecture per week, both terms.

Principles of alternating-current circuits, impedances in series and parallel, three-phase circuits. Power measurement in single-phase and polyphase circuits. The transformer and the induction motor.

348. Electrical Laboratory.

Courses 1, 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Introductory laboratory practice in methods of measuring electrical quantities. Experiments on alternating-current circuits, the transformer and the polyphase induction motor.

348a. (formerly 348). Electrical Machinery (1952-53 only).

Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.

349. Electrical Laboratory.

Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.

Experiments on direct current generators and motors, and alternating current circuits and machines.

351. Circuit Analysis. V. G. Smith.

Course 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.

Course 5e, IV Year; 2 hrs. lectures per week, both terms.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid, G. Sinclair, L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, both terms.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are anlyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. D. N. Cass-Beggs, G. F. Tracy.

Course 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Electric Circuits. L. S. Lauchland.

Course 5, II Year; 2 hrs. lectures per week, both terms.

Principles of direct-current circuits including the more important methods of measuring resistance, potential difference, current, power and energy. Principles of alternating-current circuits together with methods of calculating single-phase and polyphase circuits, network theorems.

355. Electrical Laboratory.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week, second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electric Circuits Laboratory.

Course 5, II Year, 3 hrs. laboratory alternate weeks, both terms.

Laboratory exercises to accompany subject 354.

357. Engineering Electronics. D. N. Cass-Beggs.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, first term 1 hr. lectures per week, second term.

Electronic devices, such as the thyratron, ignition and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.

Course 7, IV Year; 2 hrs. per week, both terms.

Oral presentation by each fourth year student of his thesis, together with discussions by other members of the group.

360. Communications I. J. E. Reid, G. Sinclair.

Courses 5e, 5i, 5s, 5m and 7, IV Year; 3 hrs. laboratory per week, first term.

The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.

Reference book: Electron-Tube Circuits—Seely.

361. Communications Laboratory.

Courses 5e, 5i, 5s, 5m and 7, IV Year; 2 hrs. lectures per week, both first term.

Experiments and problems to accompany subject 360.

362. Communications II. J. E. Reid, G. Sinclair.

Courses 5e and 7, IV Year; 3 hrs. lectures per week, second term.

A continuation of subject 360.

363. Communications Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory per week, second term.

Experiments and problems to accompany subject 362.

364. Operational Methods. V. G. Smith.

Courses 5e, 5i, 5m, and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Cicuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus —Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5e, 5g, 5m and 5s, IV Year; 2 hrs. lectures per week, both terms.

A comparison of the classical, the rationalized C.G.S. and the M.K.S. systems of units is made, thereafter the M.K.S. rationalized system is used exclusively. Electrostatics is developed to the point where it is used to compute the capacities of engineering structures. Magnetostatics is mentioned briefly. The laws of electromagnetism are reviewed and Maxwell's equations developed. These are applied in a study of the reflection and refraction of plane waves, in an elementary study of rectangular wave guides and of the radiation from an antenna.

Reference books: Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague. Fundamentals of Electric Waves—Skilling. Wave Guides—Lamont.

366. Electronics. V. G. Smith.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Basic theory of the behaviour of electrons in electric and magnetic fields, thermionic emission, vacuum-tube characteristics and applications, conduction through gases, gaseous-tube characteristics and applications.

Reference books: Applied Electronics—M.I.T. Staff.

367. Alternating-Current Circuits. G. F. Tracy and Staff.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Methods of treating alternating-current circuits, root-mean-square values, series circuits containing resistance, inductance and capacitance, parallel circuits, three-phase circuits.

368. Alternating-Current Circuit Laboratory.

Courses 3 and 11, II Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 367.

369. Alternating Current Machinery II. G. F. Tracy, D. N. Cass-Beggs.

Course 7, IV Year; 2 hrs. lectures per week, second term.

A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, second term.

Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises and problems to accompany subject 371.

373. Electrical Design. L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, second term. A continuation of subject 342.

374. Electrical Design Laboratory.

Course 7, IV Year; 2 hrs. laboratory per week, second term.

Design projects and exercises to accompany subject 373.

375. Electrical Engineering. A. J. Kravetz.

Course 6, II Year; 2 hrs. lectures per week, both terms.

Course 10, III Year; 2 hrs. lectures per week, both terms.

Principles of d-c and a-c circuits including the more important methods of measuring resistance, current, potential difference, power and energy; the principles of operation of d-c and a-c machinery; thermionic tube characteristics and applications.

376. Electrical Engineering Laboratory.

Course 6, II Year; 3 hrs. laboratory per week, both terms.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Laboratory exercises to accompany subject 375.

377. Electric Machines. G. F. Tracy.

Courses 3 and 5e, III Year; Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Operating characteristics, control, and applications of direct-current and alternating-current machines.

378. Electric Machines Laboratory.

Course 3, III Year; 3 hrs. laboratory alternate weeks, first term: 3 hrs. laboratory per week, second term.

Course 5e, III Year; Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

Laboratory exercises to accompany subject 377.

379. Electronics Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, second term.

Laboratory exercises to accompany subject 366.

GEOLOGICAL SCIENCES

380. Physical Geology. G. B. Langford.

Courses 2 and 9, I Year; 2 hrs. lecture per week, both terms.

An introduction to the study of geology and mineralogy.

Reference Books: Principles of Physical Geology—Holmes. Outlines of Historical Geology—Schuchert and Dunbar.

381. Physical Geology Laboratory. G. B. Langford.
Courses 2 and 9, I Year; 2 hrs. per week, second term.
A laboratory course to accompany subject 380. Local field trips.

382. Engineering Geology. A. MacLean.
Courses 1 and 5g, III Year; 2 hr. lecture per week, both terms.
Structural, dynamic and economic geology, with special reference to engineering problems.

383. Engineering Geology Laboratory. G. B. Langford.
Courses 1 and 5g, III Year; 1 hr. per week, first term; 2 hrs. per week, second term.
Specimens, maps, and sections to accompany subject 382.

384. Glacial Geology. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.

385. Elementary Geochemistry. F. G. Smith.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Covering the periodic table, distribution of the elements, states of matter, phase diagrams, natural hydrothermal solutions, weathering, and geochemical cycles.

386. Mineralogy and Lithology. E. W. Nuffield.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. lecture per week, both terms.
A study of crystallography, descriptive and determinative mineralogy, and the common rocks.
Reference book: An Introduction to the Study of Minerals—Rogers.

387. Mineralogy and Lithology Laboratory. E. W. Nuffield.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. per week, both terms.
Practice in identifying minerals and rocks.

388. Advanced Mineralogy. E. W. Nuffield.
Course 9, IV Year; 2 hrs. per week, both terms.
Continuation of the mineralogy of subject 386.

390. Morphological Crystallography.
Courses 5m and 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

391. Petrology. W. W. Moorhouse.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Microscopic character of the rock-forming minerals in thin sections, and description and classification of rocks.
Text book: Optical Mineralogy—Rogers and Kerr.

392. Petrography Laboratory. W. W. Moorhouse.
Course 9, III Year; 2 hrs. per week, both terms.
Microscopic petrography, to accompany subject 391.
Text books: As in subject 391.

393. Historical and Stratigraphical Geology. F. W. Beales.
Course 9, II Year; 2 hrs. lectures per week, both terms.
Study of the principles of stratigraphy and historical geology since Precambrian times.

394. Historical and Stratigraphical Geology Laboratory. F. W. Beales.
Course 9, II Year; 2 hrs. per week, both terms.
Laboratory work to illustrate subject 393.

395. Palaeontology. M. A. Fritz.
Course 9, III Year; 2 hrs. lectures per week, both terms.

396. Palaeontology Laboratory. M. A. Fritz.
Course 9, III Year; 2 hrs. per week, both terms.

397. Structural Geology. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Structures caused by the deformation of the earth's crust.
Text book: Structural Geology—Billings.

398. Structural Geology Laboratory. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 3 hrs. per week, both terms.
Work with geological maps of folded and faulted areas, structural sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 397.

399. Mineral Deposits. W. H. Gross.
Courses 2 and 9, III Year; Courses 5g and 8a, IV Year; 2 hrs. lectures per week, both terms.
The first term covers the metallic ore deposits and the second term the non-metallic deposits, including coal and petroleum.

400. Mineral Deposits Laboratory. W. H. Gross.
Course 9, III Year; 3 hrs. per week, both terms.

401. Geology of Canada. F. W. Beales.
Course 9, IV Year; 1 hr. lecture per week, both terms.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

403. Precambrian Geology. W. W. Moorhouse.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Precambrian formations of Canada—their rocks, distribution, relationships and economic features.

404. Precambrian Geology Laboratory. W. W. Moorhouse.
Course 9, IV Year; 2 hrs. laboratory per week, both terms.
To accompany subject 403.

405. Mining Geology. G. B. Langford.
Courses 2, 5g and 9, IV Year; 2 hrs. lectures per week, second term.
A course dealing with the application of geology to mining.
Reference book: Mining Geology—McKinstry.

406. Mining Geology Laboratory. G. B. Langford.
Course 9, IV Year; 3 hrs. per week, both terms.
A laboratory course to accompany subject 405.

407. Petroleum Geology. W. M. Tovell.
Course 9, IV Year; 2 hrs. lectures per week, both terms.
The origin, nature, and occurrence of petroleum and natural gas deposits and the extraction of these substances from the earth.

408. Petroleum Geology Laboratory. W. M. Tovell.
Course 9, IV Year; 3 hrs. per week, second term.
Accompanying subject 407.

409. Geological Field Work. G. B. Langford.
Courses 2 and 9, III Year; given at the University Survey Camp preceding the opening of the first term. Students taking this course must supply themselves with a geological pick, hand lens, and engineer's 6″ pocket scale.
Reference book: Field Geology—Lahee.

410. Geological Field Trips (Historical Geology).
Course 9, II Year (1 day).
The Niagara Escarpment and the west end of Lake Ontario.

411. Geological Field Trips (Precambrian and Mineralogy).
Course 9, III Year. 2½ days.
Bancroft and Madoc Areas.

412. Geological Field Trips (Glacial Geology). A. MacLean.
Courses 2 and 9, IV Year. Three ½ day trips.
During October weekly trips will be made to points of interest near Toronto.

413. Geological Field Trips (Petroleum).
Course 9, IV Year. 2½ days.
Oil and gas fields in Chatham area.

414. Geological Field Trips (Economic and Mining).
Course 9, IV Year. Two trips, each ½ day.
Trip to gypsum mine and cement plant.

HEAT ENGINES

420. Elementary Heat Engines. F. G. Ewens, P. B. Hughes.
Course 3, II Year; 2 hrs. lectures per week, second term.
Course 11, II Year; 2 hrs. lectures per week, second term.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

Course 7, II Year; 1 hr. lecture per week, first term.

Course 10, III Year; a reading course.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut, F. C. Hooper.

Course 3, III Year; 2 hrs. lectures per week, both terms.

Courses 7, 8a and 10, III Year; 2 hrs. lectures per week, both terms.

Course 11, III Year, 2 hrs. lectures per week, both terms.

For each group selected topics are arranged to suit the courses included in the group.

The application of the laws of thermodynamics to ideal processes and cycles using gases and vapours. The cycles used in practice for steam and internal combustion engines, compressors and refrigerating plants. Unavailable energy and entropy. Theoretical and practical efficiencies obtainable. Heat transfer and regeneration. Tables and charts for vapours used in engineering practice.

Reference book: Elementary Engineering Thermodynamics—Young and Young.

422. Heat Engineering. R. C. Wiren, W. A. Wallace, F. C. Hooper.

Courses 3 and 5t, III Year; 2 hrs. lectures per week, both terms.

Steam Turbines. Types and basic characteristics; condensers and auxiliaries.

Steam Generators and Plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design of boilers, furnaces, stokers, pulverised fuel equipment, economizers, air heaters, superheaters, etc.

Internal Combustion Engines. Types and operation; performance and testing; basic characteristics and principles of design; carburation; fuel injection; governing.

Heat Transfer and Air Conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Reference books: Internal Combustion Engines—Polson. Maleev. Obert. Fraas. Steam Turbines—Church. Steam Power Plants—Gaffert. Potter. MacNaughton. Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Courses 3, 5t, and 10, III Year; 1 three-hour laboratory period per week, both terms.

Course 7, III Year; 1 three-hour laboratory period per week first term.

Courses 6 and 11, III Year; 1 three-hour laboratory period per week, second term.

The laboratory work is designed to assist in clearer understanding of theory and practical applications, and consists of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

The work on Heat Engines deals with the setting of slide valves, measuring indicated and brake horse-power, the use of power plant instruments and auxiliaries, testing of air compressors, steam engines, steam turbines and internal combustion engines under various conditions, steam calorimetry and the solution of numerous practical problems.

The Fuel Testing includes analysis of fuels and products of combustion, knock rating of gasolines, fuel calorimetry, etc.

The work on Heat Transfer deals with temperature measurement, tests on insulation and heat exchangers of various kinds.

The work on air conditioning deals with the use of instruments and charts, air conditioning standards and the solution of practical problems.

424. Heat Power Engineering. R. C. Wiren.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

A continuation of lecture course 421 consisting of a more advanced study as applied to power plants. Properties of pure substances. Analysis and applications of the First and Second Laws. Change of phase and equations of state. Thermodynamic functions and relations as applied to a perfect gas and working fluids used in power plants. Steam as a working fluid. Steam turbines. Power plant cycles including reciprocating engines and turbines. Cycles for high pressures and temperatures. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies. Design of power plant equipment.

Reference books: Heat and Thermodynamics—Zemansky. Engineering Thermodynamics—Obert. Sears. Everett. Keenan. Ebaugh. Hawkins. Steam Power Plants—Gaffert. Potter. MacNaughton. Steam Turbines—Church. Salisbury.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3 and 5t, IV Year; 1 hr. lecture per week, both terms.

The various types of internal combustion engine and their respective applications. The different cycles of operation and the avoidable and unavoidable losses. The admission, compression, combustion, expansion and exhaust operations, the factors that influence them and their application to the engine and turbine. The cooling system and its effect on thermal and mechanical conditions.

426. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Course 3, IV Year; 5 hrs. laboratory work per week, both terms.

Course 5t, IV Year; 6 hrs. laboratory work per week, both terms.

A continuation and extension of the work covered in the III Year laboratory subjects consisting of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

In the Heat Engine laboratory complete tests are made of various engines such as simple, compound and uniflow steam engines, impulse and reaction type steam turbines, steam injectors, gas, oil and gasoline engines. In each case an analysis is made of the thermal cycle involved, a complete set of experiments is performed and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Problems involving variable specific heat are studied.

In the Fuel Testing laboratory the octane rating of gasoline samples is determined by A.S.T.M. methods and fuel injection spray characteristics are studied with special test equipment.

In the Heat Transfer laboratory tests are made on heat exchangers.

In the Air Conditioning and Refrigeration laboratory tests are performed on complete air conditioning systems, and complete refrigerating plants.

427. Theory of Heat Engines. R. C. Wiren.

Course 1, III Year; Course 2, IV Year; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to engines, nozzles, turbines, compressors, heat transfer devices, refrigeration plants, and air conditioning systems. Analysis of vapour and gas power cycles.

Text book: Basic Thermodynamics—Brown.

Reference books: Engineering Thermodynamics—Young, Ebaugh. Theory and Practice of Heat Engines—Faires.

428. Heat Engine Laboratory. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Course I, III Year; eight 3-hr. laboratory periods, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and

controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

430. Heat Power Engineering. R. C. Wiren.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Application of Thermodynamics to the design of power plant equipment. Analysis of high pressure and high temperature vapour cycles. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies.

Reference books: Steam Power Plants—Gaffert. Potter. MacNaughton. Steam Turbines—Church, Salisbury. Engineering Thermodynamics—Obert, Keenan, Hawkins.

431. Theory of Heat Engines. P. B. Hughes.

Course 6, III Year; 2 hrs. lectures per week, first term.

The theory and practice of heat engines, including a study of fundamental principles involved, an appraisal of theoretical developments, and a survey of the corresponding practical applications.

Text book: Theory and Practice of Heat Engines—Faires.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Courses 2 and 8a, III Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes and open channels, with a brief discussion of the resistance of submerged bodies, dimensiona analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, D. G. Huber, M. J. Kenn.

Courses 1, 3, 7, and 11, III Year; one 3-hr. laboratory period per week, second term.

Course 2, III Year; six 3-hr. laboratory periods, first term.

Course 8a, III Year; one 3-hr. laboratory period per week, first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. The lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc. are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3- and 2-hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomena, fans and ductwork, and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps. Turbines and water power developments.

446. Hydraulic Laboratory. G. R. Lord, D. G. Huber.

Course 1, IV Year; one 3-hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. L. E. Jones.

Courses 1, 7, and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure density-height relationships. Measurement of pressure intensity. Fluid thrust on submerged surfaces. Buoyancy and flotation.

448. Mechanical and Thermal Measurements. L. E. Jones.

Courses 2, 3, 7, 9, and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities, and means of measuring them. Dimensions, units, standards, length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 3 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analysing technical data; elements of curve-fitting and statistical treatment.

In order to prepare the student for subsequent laboratory and design work, the material of this course will be based on elements of fluid mechanics and hydraulics.

450. Hydraulics. D. G. Huber.

Course 5t, III Year; 1 hr. lecture per week, both terms.

A course emphasizing the fundamentals of fluid flow in pipes with special reference to refrigeration problems and including discussion of pumps.

Reference books: Elementary Fluid Mechanics—Vennard. Centrifugal Pumps and Blowers—Church. Refrigerating Data Book.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

MACHINERY

461. Mechanical Engineering. J. W. Church.

Course 3, II Year; 2 hrs. lectures per week, both terms.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

462. Elementary Machine Design. R. T. Waines.

Course 7, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machining, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting

room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Manufacturing Equipment and Processes—Lytle and Gould.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design (involving material applications and calculation of stresses) and selection of various machine elements with particular application to power transmission (belting, shafting and gearing), fastening screws, power screws and wire rope.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory will illustrate the lecture subject.

465. Theory of Machines. I. W. Smith.

Course 3, II Year; 3 hrs. lectures per week, both terms.

Course 10, II Year; 3 hrs. lectures per week, first term.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical application. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams, including inertia effects. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating and reciprocating parts.

Text book: Mechanism—Prageman.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Text book: Vibration; Mechanical Vibrations—Thomson.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Members—Vallance & Doughtie.

468. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, III Year; 6 hrs. laboratory per week, both terms.
Course 7, III Year; 3 hrs. laboratory per week, second term.
Course 10, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, both terms.

Design laboratory work will be taken by students in all courses listed above. This will involve the design of machine elements with the object of illustrating the work covered in the lecture subjects in Machine Design. Sketching and drafting will be given with a view to developing the student's judgment and sense of proportion in design and the application of drafting room standards.

Mechanics of Machinery laboratory work will be taken by Course 3 only. This will include the analytical and graphical solution of problems dealing with inertia loads and stresses and the determination of speed fluctuation.

Mechanical laboratory work will be taken by Courses 3 and 10. This will include selected experiments in speed measurement, oil testing, balancing, vibrations, testing of power drives, etc.

Machine and Welding Shops laboratory work will be taken by all groups. This will take the form of demonstrations of equipment in these shops with a view to assisting students in the visualization of manufacturing methods employed for parts being designed.

469. Machine Design. R. T. Waines.

Courses 2, 8, and 8a, IV Year; 1 hr. lecture per week, both terms.

The design and selection of machinery and equipment met with in metallurgical plants, and in mining work.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6, 8, and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. W. G. McIntosh.

Course 5, III Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Members—Vallance & Doughtie.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

This is a continuation of Subjects 467 and 466. It will involve the design of various machine elements and equipment including machine frames, hooks, hoisting equipment, crankshafts, gears (helical, herringbone, bevel, screw, and worm), springs, clutches, brakes, thin and thick wall vessels.

An introduction will be given to the study of vibration problems encountered in high speed engines and machines.

Text book: Design of Machine Elements—Faires.

474. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Advanced laboratory work involves both analysis and design of machine elements, machine units, and complete machines. The selection of problems is made with a view to giving the student as broad a coverage as possible and providing experience in combining of elements to form a machine of smooth and harmonious design. Some of this work will involve special shafting problems including graphical solutions, critical speeds, and multiple supports.

Work will be given in the Mechanical Laboratory on gauging and fine measurements, experimental stress analysis, vibration, and bearing testing.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Members—Vallance & Doughtie.

476. Manufacturing Processes. J. W. Church.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

Text book: Manufacturing Processes—Begeman.

Reference books: Handbook on Designing for Quantity Production—Chase. Casting and Forming Processes in Manufacturing—Campbell. Machine Tools for Engineers—Hine. Manufacturing Processes (2 vols.)—Rusinoff.

477. Manufacturing Processes Laboratory. J. W. Church.
Course 11, IV Year; 3 hrs. laboratory per week, both terms.
Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

478. Machine Design. I. W. Smith.
Course 5t, IV Year; 1 hr. lecture per week, both terms.
A series of lectures intended to supplement subject 471 of the Third Year, while co-ordinating with the Fourth Year thermodynamic subjects, by presenting the overall approach employed in the design of simple power units.

479. Machine Design. R. T. Waines.
Course 6, IV Year; 2 hrs. lectures per week, both terms.
The design of various machine elements, particularly those likely to be met with in chemical plants, and an outline of the properties, production methods, and selection of materials used in machine equipment.

480. Mechanical Engineering Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.
Course 3, II Year; 3 hrs. laboratory per week, both terms.
Problems will be given in mechanical engineering, including velocity, acceleration, and force analyses; speed fluctuation; cam layout; gearing; and balancing.

MATHEMATICS

490. Calculus. S. Beatty, A. J. Coleman, I. R. Pounder, B. Lapidus, A. W. Walker.
Courses 1, 2, 3, 6, 7, 8, 9, and 11, I Year; 2 hrs. lectures per week, both terms.
Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

491. Calculus. J. D. Burk, B. Lapidus, E. E. Noonan, G. de B. Robinson.
Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.
Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289.

492. Analytical Geometry. S. Beatty, A. J. Coleman, B. Lapidus, I. R. Pounder, A. W. Walker.
Courses 1, 2, 3, 6, 7, 8, 9, and 11, I Year; 1 hr. lecture per week first term: 2 hrs. lectures per week second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate the general methods of analytical geometry. Introduction to Analytical Geometry of Three Dimensions. In addition, problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

494. Least Squares. O. J. Marshall, H. L. Macklin.

Course 1, II Year; 3 hrs. laboratory per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulæ.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes.

495. Mathematical Problems. W. J. Webber, D. A. F. Robinson, W. T. Tutte, G. Feldman.

Courses 5 and 10, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. W. J. R. Crosby.

Courses 5 and 10, I Year; $3\frac{1}{2}$ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books: Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. W. J. R. Crosby.

Courses 5 and 10, I Year; $1\frac{1}{2}$ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. W. T. Tutte.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger.

Courses 1, 3, 6, 8, and 11, III Year; 1 hr. lecture per week, both terms.

First order equations solvable by quadratures, linear equations of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorf, and Pohlhausen.

509. Differential Equations. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. J. A. Steketee.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. Robinson, J. A. Steketee.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

METALLURGY

530. Metallurgy. L. M. Pidgeon, B. Chalmers.

Course 8, II Year; 1 hr. lecture per week, both terms.

Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations, and principles of physical metallurgy.

531. Metallurgical Problems Laboratory. H. U. Ross.

Course 8, III Year; 2 hrs. laboratory per week, both terms.

Problems in physical chemistry and thermodynamics as applied to metallurgical reactions.

532. Physical Metallurgy 1. B. Chalmers, E. Thall.

Course 11, II Year; Course 3, III Year; 1 hr. lecture per week, both terms.

A general course in Physical Metallurgy, dealing with the structure of metals and alloys, with special reference to the ferrous and non-ferrous alloys of practical importance. The influence of mechanical deformation, heat treatment and composition on the structure is considered, and the relation between the structure and the mechanical properties is examined.

534. Principles of Extractive Metallurgy. L. M. Pidgeon.

Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A general discussion of the fundamental principles of extractive metallurgy with reference to the production of the more important metals.

535. Principles of Extractive Metallurgy Laboratory. H. U. Ross.

Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.

Experiments in pyrometry, roasting, smelting, leaching, retorting and refining designed to illustrate the principles underlying these operations. Spectrographic analysis of metals is included.

536. Principles of Physical Metallurgy. B. Chalmers.
Courses 5m and 8, III Year; 2 hrs. lectures per week, both terms.
One hour lecture per week in first term consists of a series of lectures on the structure of solids, with particular reference to x-ray methods of investigation.

537. Physical Metallurgy Laboratory. B. Chalmers, E. Thall.
Courses 5m and 8, III Year; 3 hrs. laboratory per week, both terms.
Practical work relating to subject 536.

538. Metallurgy. L. M. Pidgeon.
Course 2, IV Year; 1 hr. lecture per week, both terms.
The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes

539. Metallurgy Laboratory. H. U. Ross.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgical Problems Laboratory. H. U. Ross.
Course 8, IV Year; 2 hrs. laboratory per week, both terms.
Problems dealing with subject matter in subjects 542 and 552.

541. Metallurgy Laboratory. H. U. Ross.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term.
A continuation of subject 535.

542. Non-Ferrous Production Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Extractive metallurgy of the non-ferrous metals, including electrometallurgy.

543. Physical Metallurgy. B. Chalmers.
Courses 5m and 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536.

544. Physical Metallurgy Laboratory. B. Chalmers, E. Thall.
Courses 5m and 8, IV Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practical work relating to subject 543.

546. Physical Metallurgy. B. Chalmers, E. Thall.
Course 1, III Year; 2 hrs. lectures per week, first term.
A short course on the influence of heat and mechanical treatment on the structure and properties of steels and the more important non-ferrous alloy.

547. Physical Metallurgy 2. B. Chalmers, E. Thall.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 532.

548. Physical Metallurgy Laboratory. B. Chalmers, E. Thall.
Courses 3 and 11, IV Year, 1½ hrs. laboratory per week, second term.
A practical course illustrating the principles dealt with in subjects 532 and 547.

549. Physical Metallurgy. B. Chalmers, E. Thall.
Courses 5e, 5s, 5i, 5g, 5t, 7, and 8a, III Year; Courses 2, 9, and 10, IV Year; 1 hr. lecture per week, both terms.
A short course in Physical Metallurgy; stucture of metals and alloys; effects of mechanical distortion and heat treatment on structure; relation between structure and mechanical properties; and properties of some steels and non-ferrous alloys.

550. Metallurgical Theory. W. C. Macdonald.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

552. Ferrous Production Metallurgy. H. U. Ross.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Production metallurgy of iron and steel.

CERAMICS

560. Ceramic Minerals and Calculations. P. M. Corbett, B. Chalmers.
Course 8a, III Year; 4 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.
Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term. One hour per week first term to be devoted to a joint lecture with subject 536 on structure of solids.

561. Heavy Clay Products Laboratory. P. M. Corbett.
Course 8a, III Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. P. M. Corbett.
Course 8a, III Year; 2 hrs. lectures per week, second term.
The composition of clear and coloured glazes.

565. Refractories and Ceramic Bodies. P. M. Corbett.
Course 8a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. P. M. Corbett.
Course 8a, IV Year; 1 hr. lecture per week, both terms.
Composition and manufacture of glass and iron enamels.

568. Whitewares and Enamels Laboratory. P. M. Corbett.
Course 8a, IV Year; 6 hrs. laboratory per week, both terms.
Advanced work on the compounding and testing of non-metallic mineral products.

MODERN LANGUAGES

610. English.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, I Year; 2 hrs. lectures per week, both terms.
(*a*) Literature: King Lear—Shakespeare (Crofts); Samson Agonistes—Milton (Crofts); Saint Joan—Shaw (Penguin); Joseph Andrews—Fielding (Everyman); Tess of the D'Urbervilles—Hardy (Macmillan); Passage to India—Forster (Everyman); Selected Poems—Wordsworth (Crofts); Selected Poems—Keats (Crofts); Selected Poems—T. S. Eliot (Penguin); Essays—Bacon (Crofts); On Liberty—J. S. Mill (Crofts); Four Essays, ed. E. K. Brown—Matthew Arnold (Crofts); Final examination on these texts.
(*b*) Composition: Study of textbook to be selected by instructor; writing of original compositions: final examination in practical composition.

PHYSICAL EDUCATION

640. Physical Education.
All courses, I and II Years.
The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. G. D. Scott, J. N. P. Hume.
Courses 5 and 10, I Year; 4 hrs. lectures per week, both terms.
In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.
Text books: Physics, Vol. 1—Shortley and Williams. Principles of Physics, Vol. 1—Sears. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. G. D. Scott, J. N. P. Hume, Miss K. M. Crossley.
Courses 5, and 10, I Year; 3 hrs. laboratory per week, both terms.
Supplementary to subject 650.

652. Elementary Magnetism and Electricity. R. W. McKay.
Courses 5, 8, and 10, II Year; 2 hrs. lectures per week, both terms.
Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.
Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.

Courses 5, 8, and 10, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

655. Physics Laboratory (Magnetism and Electricity and Light).

Course 5, II Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Courses 8, and 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Physics of Solids and Fluids. C. Barnes.

Course 5, III Year; 1 hr. lecture per week, both terms.

Gravitational potential and Laplace's equation. Vibration theory –damped motion, coupled oscillations, etc. Elasticity. Introduction to fluid motion and heat conduction. Differential equations of quantum mechanics.

657. Thermodynamics and Kinetic Theory. D. G. Ivey.

Course 5, III Year; 3 hrs. lectures per week, both terms.

Temperature scales, thermometry, calorimetry. First and Second laws, Entropy and Kelvin Thermodynamic Scale, equations of state, the Virial expansion. Ideal and van der Waal's gases. Specific heats. Thermodynamic functions. Joule-Thomson effect. Radiation and pyrometry up to Wien and Planck Laws. Distribution of velocities. Transport Phenomena. Brownian motion.

659. Physical Laboratory. D. G. Ivey.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term.

Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, W. H. Watson, H. L. Welsh.
Courses 5e, 5i, 5g, 5m, and 5s, IV Year; 3 hrs. lectures per week, both terms.
Introduction to quantum theory, atomic, molecular and nuclear physics.

665. Physical Laboratory. H. J. C. Ireton.
Course 5s, IV Year; 9 hrs. laboratory per week, both terms.
Course 5m, IV Year; 6 hrs. laboratory per week, both terms.
Accompanying the lecture subjects 663, 666, and 669.

666. Advanced Optics. M. F. Crawford.
Course 5s, IV Year: 2 hrs. lectures per week, both terms.
Diffraction, interference, and polarisation.
Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams. Cours d'Optique—Bruhat.

669. Analysis of Materials by Spectrographic and X-Ray Methods. H. J. C. Ireton.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.
Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. G. D. Garland, D. V. Anderson.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, thermometric, and radioactive methods.
Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. G. D. Garland, D. V. Anderson.
Course 9, IV Year; 1 hr. lecture per week, both terms.
Introduction to physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.
Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. G. D. Garland, D. V. Anderson.
Course 5g, IV Year; 6 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 670.

673. Geophysics. G. D. Garland, D. V. Anderson.
Course 9, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.
Course 5i, IV Year; 3 hrs. laboratory per week, both terms.
Accompanying subject 663.

675. Physics of the Earth. J. T. Wilson, G. D. Garland.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

676. General Physics. J. N. P. Hume.
Courses 6 and 8, I Year; 3 hrs. per week, both terms.
A first course in physics including an introduction to modern conceptions of matter.

677. Physics Laboratory.
Courses 6 and 8, I Year; 3 hrs. laboratory per week, both terms.
A course designed to accompany subject 676.

PRACTICAL EXPERIENCE

690. Practical Experience.
Course 1.
Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.
Course 2.
Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.
The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

694. Practical Experience.

Course 6.

Every student in Chemical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 800 hours' experience in work connectedwith engineering practice of a nature acceptable to the department.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit before graduation, evidence of having had at least 1200 hours of practical engineering experience satisfactory to the department. Certificate forms may be obtained from the departmental office and the completed certificates should be returned to the department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before

graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development, underground work or service on geological field parties, and at least half of the time should be spent underground. Forms to be used in submitting experience record are available in the Department of Geological Sciences office.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, O. J. Marshall, H. L. Macklin, W. H. Carr.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the tape, the transit, and the level, and computation of corrections, azimuths, bearings, latitudes and departures, co-ordinates and areas.

Text book: Printed notes on Elementary Surveying—Staff in Surveying.

Reference books: Surveying—Philip Kissam. Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed.

712. Field Work. W. M. Treadgold, O. J. Marshall, H. L. Macklin, W. H. Carr, T. L. Rowe, M. B. Wong.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; keeping of field notes; the use of the transit in surveying closed figures and traverse lines; plotting by co-ordinates; computing of areas; instrumental work with the level and calculating the volume of excavations.

714. Surveying. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, compound and spiral curves as applied to highway and railroad surveying. Main features of mine and hydrographic surveying.

Text books: Printed notes—Staff in Surveying. Route Surveys—Skelton.

715. Surveying. H. L. Macklin.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term, 2 hrs. lecture per week, second term.
Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.
Text books: Surveying—Breed and Hosmer. Introduction to Mine Surveying—Staley.

716. Survey Camp and Field Work. W. M. Treadgold, O. J. Marshall, H. L. Macklin, W. H. Carr.
Course 1, II Year; 2 weeks at Survey Camp (Dorset), Sept. 8 to Sept. 20.
Course 1, II Year; 3 hrs. per week, second term.
Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and curves.

717. Survey Camp and Field Work. H. L. Macklin, O. J. Marshall, W. H. Carr.
Courses 2 and 9, II Year; 2 weeks at Survey Camp (Dorset), Sept. 8 to Sept. 20.
Courses 2 and 9, II Year; 2 hrs. per week, first term.
Adjustments of the transit and level, minor problems in triangulation and traversing, levelling, curves and topography.

718. Construction Surveying. W. H. Carr.
Course 1, III Year; 2 hrs. lectures per week, second term.
Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.
Earthwork:
(*a*) Cross sectioning.
(*b*) Computation of volume.
(*c*) Mass or haul diagram.
Transition and Vertical curves (including super-elevation).
Railway turnouts and sidings.
Layout of roads and sewers.

720. Survey Camp. W. M. Treadgold, O. J. Marshall, J. W. Melson, H. L. Macklin, B. J. Haynes, W. H. Carr, G. B. Langford, W. W. Moorhouse.
Courses 1, 2, and 9, III Year: Aug. 18 to Sept. 20—Gull Lake.
Course 1:
(*a*) Secondary Triangulation and Base Line Measurements.
(*b*) Highway and Railway Location.
(*c*) Cross Sectioning and Computation of Earthwork.
(*d*) Stadia and Plane Table Topography.
(*e*) Observations for Time, Azimuth, and Latitude.
Courses 2 and 9:
(*a*) Stadia and Plane Table Topography.
(*b*) Mine Surveying, using overhead stations.
(*c*) Shaft plumbing and use of Auxiliary Telescope.
(*d*) Geological Surveying and mapping.

Students in Courses 1, 2, and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year; 2 hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instructions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis Seminar.

Course 5, IV Year.

Each student in the Fourth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training for those fields.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the

Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

737. Thesis.

Course 8a, IV Year

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, first term.

Each student must collect suites of rocks and minerals or fossils during the summer vacation preceding the IV Year. This material must be identified and described during the first term, and the report covering this work must be submitted by January 31st of the IV Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course 11, IV Year.

Each student in the Fourth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work in each subject is 50% and a student must obtain a weighted average of 60% in order to pass in the work of the year. He shall be required to pass a supplemental examination in each subject in which he obtains less than 50%. Subjects will be weighted according to the number of hours devoted to them, the hours assigned to laboratory subjects being given one half the weight of those in lecture subjects.

5. Honours and scholarships will be awarded upon the basis of the weighted average.

6. Honours will be awarded to a student, who at the Annual Examinations passes in all written and laboratory subjects and who also obtains a weighted average of 75% on the work of the year.

7. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

8. A student who fails in the work of any year, provided he is otherwise eligible, will be permitted to register provisionally for the purpose of repeating the year.

9. If the performance of a student repeating the First Year is unsatisfactory during the first term, as determined by laboratory marks and written examinations, he may be required to withdraw.

10. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

11. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they failed before presenting themselves a second time for examination.

12. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

13. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

14. A student who has failed to complete satisfactorily the course in Physical Education prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Education prescribed for the Second Year will not be permitted to register in the Fourth Year.

15. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 25th day of August, 1952. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by the order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. MEDALS, PRIZES, SCHOLARSHIPS, BURSARIES AND FELLOWSHIPS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

In order to be eligible for a medal, prize, scholarship, bursary, fellowship or other awards granted solely upon standing obtained at an annual or special examination or upon an essay, or term work, or other academic rating, a candidate must obtain honours at such annual or special examination or upon such essay, term work, or other academic rating unless the statute respecting the award or medal specifies that standing lower than honours may be accepted.

When an award or medal is granted upon standing obtained on part of the work of any academic year the candidate must obtain standing but need not obtain honours in the work of the academic year as a whole, provided he obtains honours in the part concerned, unless the statute respecting the award or medal specifies otherwise.

No medal, prize, scholarship, bursary, fellowship or other award will be granted to a candidate who is conditioned in any subject at an annual examination or in Physical Education unless the statute respecting the award or medal specifies otherwise.

A candidate will not be permitted to receive more than one award in a session unless the statute establishing each of the awards concerned or the Calendar specifies otherwise. Only one of those marked by an asterisk may be held in any one year. A candidate who would, but for this provision, have received more than one award may have his name so published in the class lists.

A candidate who has spent two sessions in any year of an undergraduate course is not eligible to compete for any award at the annual examinations of that year.

Medals, after they have been suitably engraved, will be given without delay to the winners or forwarded to them by registered mail.

Awards granted to members of graduating classes other than awards for graduate study and research, will be paid in one instalment as soon as possible after the granting of the awards.

All other awards will be paid (i) if of the value of $50 or less, in one instalment on November 20 and (ii) if of the value of more than $50 in two equal instalments, the first on November 20 and the second on February 20, in the session following the granting of the awards provided that no payment is made to a candidate (*a*) who is not in regular attendance upon lectures and laboratory classes in the Faculty, or if the Calendar so specifies, in the course in which the award is established or granted (*b*) who does not present at the Chief Accountant's Office before each payment a certificate of attendance upon lecture and laboratory classes signed by two senior members of the staff.

The Senate may, on the recommendation of the Faculty, permit a candidate to whom an award has been granted to postpone attendance upon lectures and laboratory classes for one year. Further postponement may be permitted on application.

Name	Amount	Application required	Available only to a limited group or single course	See page
Available to Students Entering the First Year				
Applied Science Bursaries.....	$2000	Yes	No	138
Class of 1937 Engineering Bursary......................	$100	Yes	No	138
Hagarty Memorial Scholarship	$60	Yes	Yes	138
U.T.S. Engineering Scholarship	$250	Yes	Yes	139
The Leonard Foundation Scholarships..............	—	Yes	Yes	139
The Robert Simpson Company Scholarship................	$100	Yes	Yes	139
O.H.A. War Memorial Scholarship...............	$200	Yes	Yes	140
Engineering Alumni Admission Scholarship................	$300	Yes	No	140
Students' Administrative Council Admission Scholarship...	$350	Yes	Yes	140

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	141
*Baptie Scholarship..........	—	No	Yes	141
MacLennan-MacLeod Memorial Prize..............	$25	No	No	141
*Ransom Scholarship in Chemical Engineering...........	$150	No	Yes	142
T. H. Bickle Prize...........	$30	No	Yes	142
*John M. Empey Scholarship..	$100	No	No	142
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics.......	$60	No	Yes	143
*Wallberg Undergraduate Scholarships..............	$600	No	No	143
Paulin Memorial Scholarship..	$300	No	Yes	143
*Association of Professional Engineers of the Prov. of Ontario Scholarships(3).....	$225	No	Yes	145
Hugh Gall Award...........	$100	Yes	No	144
University Naval Training Division Bursaries.........	$100	Yes	Yes	144
S. Ubukata Fund............	—	Yes	Yes	144
University of Toronto General Bursaries.................	—	Yes	No	160
Dominion-Provincial Student-Bursaries................	—	Yes	No	160
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship..........	£400	Yes	No	153
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	141
*Harvey Aggett Memorial Scholarship..............	$75	No	No	145
J. A. Findlay Scholarship.....	—	No	Yes	145
*Association of Professional Engineers of the Province of Ontario Scholarships (3)....	$225	No	Yes	145
T. H. Bickle Prize...........	$30	No	Yes	142

Name	Amount	Application required	Available only to a limited group or single course	See page
Edith Tyrrell Memorial Bursary	$300	Yes	Yes	146
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships	—	No	Yes	146
*John M. Empey Scholarship	$100	No	No	142
W. G. Millar Memorial Scholarship	$250	Yes	Yes	147
*Wallberg Undergraduate Scholarships	$300	No	No	143
Ardagh Prize	$50	No	Yes	147
James L. Morris Memorial Prize	$60	No	Yes	148
University of Toronto General Bursaries	—	Yes	No	160
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	160
Scottish Rite Masons Bursary.	$100	Yes	Yes	144
Eastern Steel Products Limited Scholarship	$350	Yes	Yes	148
Egerton S. Noble Scholarships (2)	$500	No	No	148
Available to Students Completing the Third Year				
Rhodes Scholarship	£400	Yes	No	153
*Boiler Inspection and Insurance Company Scholarship	$150	No	Yes	149
University Alumni Federation War Memorial Scholarships.	$250	Yes	No	141
*Jenkins Scholarship in Engineering	$200	No	No	149
Heating and Ventilating Engineers Prize	$50	No	No	149
E.I.C. Prize	$25	No	Yes	149
Engineering Society Semi-Centennial Award	$75	No	No	150
J. A. Findlay Scholarship	—	No	Yes	145
*Association of Professional Engineers of the Province of Ontario Scholarships (3)	$225	No	Yes	145
T. H. Bickle Prize	$30	No	Yes	142
Edith Tyrrell Memorial Bursary	$300	Yes	Yes	146

Name	Amount	Application required	Available only to a limited group or single course	See page
Archie B. Crealock Memorial Prize	$25	No	Yes	150
*John M. Empey Scholarship	$100	No	No	142
Hudson Bay Mining and Smelting Company Limited Scholarships	$800	Yes	Yes	150
*Wallberg Undergraduate Scholarships	$300	No	No	143
Chemical Institute of Canada Prize	$25	No	Yes	151
Kennecott Copper Corporation Scholarship	$1000	No	Yes	151
RCE Memorial Scholarship	$125	Yes	Yes	152
Geo. W. Crothers Limited Scholarship	$250	Yes	No	150
Charles H. Sage Scholarships (2)	$500	No	No	148
University of Toronto General Bursaries	—	Yes	No	160
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	160
Loan Funds	—	Yes	No	160
AVAILABLE TO STUDENTS				
COMPLETING THE FOURTH YEAR	—			
B.A.A.S. Medal		No	No	151
Heating and Ventilating Engineers Prize	$50	No	No	149
INCO. Scholarship	$500	Yes	Yes	151
"Second Mile Engineer" Award	$100	No	Yes	152
Henry G. Acres Medal	—	No	Yes	152
Massey-Harris Co. Ltd. Scholarships (2)	$500	Yes	Yes	152
Geo. W. Crothers Limited Scholarship	$250	Yes	No	150
Ontario Section, American Society for Metals Prize	$50	No	Yes	151
University of Toronto General Bursaries	—	Yes	No	160
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	160
Loan Funds	—	Yes	No	160

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO GRADUATES				
Rhodes Scholarship..........	£400	Yes	No	153
1851 Exhibition Science Research Scholarships........	£275	Yes	Yes	154
McCharles Prize.............	$1000	No	No	155
Nipissing Mining Research Fellowships...............	$600	Yes	No	155
H. W. Price Research Fellowship in Electrical Engineering.....................	—	Yes	Yes	156
C.I.L. Fellowship in Chemistry	$1200	Yes	Yes	156
T. A. Russell Memorial Research Fellowship..........	$1000	Yes	Yes	156
Consolidated Mining and Smelting Company Fellowship...	$1000	Yes	No	156
Canadian Lumbermen's Association Timber Research Fellowship................	$1000	Yes	No	157
Imperial Oil Graduate Research Fellowships........	$4000	Yes	Yes	157
Wallberg Research Fellowships	$3000	Yes	No	157
Arthur Hays Sulzberger Fellowship..................	$1000	Yes	No	157
Babcock-Wilcox and Goldie-McCulloch Limited Fellowship.....................	$1500	Yes	Yes	158
Athlone Fellowships.........	—	Yes	No	158
1940 Toronto Fund..........	—	Yes	No	159
Raymond Priestley Fellowship	£450	Yes	No	159
Royal Institution of Great Britain Science Research Scholarships..............	£350	Yes	No	159

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

In those cases where the amount of the award is not payable from income earned on an endowed fund, payment will be dependent on the receipt of the amount of the annual award from the donor.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $200, will be awarded in 1952 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1952. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

CLASS OF 1937 ENGINEERING BURSARY

The class of 1937 presents annually a bursary of $100 to assist worthy engineering candidates to enter the Faculty. The award is based on the student's high school standing and on his need for financial assistance.

The recipient is selected from applicants for Applied Science Bursaries, and from candidates sponsored by Engineering Counsellors and by members of the Class of 1937.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among

the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School, the Kapuskasing High School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute and Vocational School, from whom further information may be obtained regarding conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidate shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidate shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities

of North Bay, Sudbury, Sault Ste. Marie Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, in the School of Architecture, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent. at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Five scholarships and awards, each of the value of $20.000 will be granted in 1952-53 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of financial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that a scholarship of one half the annual income shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemica Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. If in any year no award is made, a second award will be available in a subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open

to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards listed in the Calendar with an asterisk. The awards were first made on the result of the annual examination of 1947.

Paulin Memorial Scholarship

The Paulin Memorial Scholarship, provided through the generosity of Mr. Fred W. Paulin, a graduate of the Faculty in 1907, was established in memory of his brother, John Cameron Paulin, a student in Mining Engineering, who was fatally injured in 1906 during a football practice. The Scholarship which has a value of $300.00, is awarded on the recommendation of the Department of Mining Engineering to a student registered in Mining Engineering, who has successfully completed the work of the First Year.

The award is made on the following bases:

(*a*) academic proficiency.

(*b*) qualities necessary for the development of leadership, such as ambition, initiative, resourcefulness and strength of character.

(*c*) he must continue his studies in Mining Engineering during the following session.

The first award was made for the Session 1951-52.

HUGH GALL AWARD

The Hugh Gall Award, of the annual value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946 for a five year period and, through the generosity of Mrs. Hugh Gall extended for a further three year period. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions, has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session. A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

THE SCOTTISH RITE MASONS' BURSARY

The Scottish Rite Masons' Bursary, the gift of the Scottish Rite Masons of Toronto, of the value of $100. is awarded to a student enrolled in the Second Year who is a member of the Masonic Order, or a son, brother, nephew, daughter, sister or niece of a member of the Masonic Order. Consideration will be given to financial need and academic standing. Evidence of connection with the Masonic Order and information regarding financial need must be given with the application which must be submitted to the Secretary of the Faculty.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head

of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering:—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

EDITH TYRRELL MEMORIAL BURSARY

The Women's Association of the Mining Industry of Canada has presented this Bursary, having the value of Three Hundred Dollars, annually, commencing in 1939, and named in memory of their founder and first president, Mrs. Edith Tyrrell. A medal donated by Dr. Tyrrell accompanies the Bursary. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. McKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Department of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endownment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course of Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00 is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at

the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examination of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris, C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income from $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the Examinations of the Second Year.

EASTERN STEEL PRODUCTS LIMITED SCHOLARSHIP

The Eastern Steel Products Limited Scholarship of an annual value of $350.00 has been established in the course in Mechanical Engineering for a period of five years.

The Scholarship will be awarded to a student entering the Third Year in Mechanical Engineering who:

(*a*) was registered in the course in Mechanical Engineering in this Faculty in his First and Second Years.

(*b*) obtained Honours in the work of the First and also of the Second Year.

(*c*) gives evidence not only of mental capacity but who also shows leadership ability, and gives promise of becoming a worth while influence in affairs of the profession and the community.

Consideration is given to financial need.

Application must be made to the Secretary of the Faculty not later than March 15.

The first award was made at the Annual Examinations of 1948.

SPRUCE FALLS POWER AND PAPER COMPANY LIMITED SCHOLARSHIPS

The Spruce Falls Power and Paper Company Limited has established four Scholarships of a value of $250.00 each, two in the Second Year known as the Egerton S. Noble Scholarships and two in the Third Year known as

the Charles H. Sage Scholarships. They are awarded on the results of the Annual Examinations of the Second and Third Years to the students who stand first and second at the examinations of their respective years and are open to students in all courses in the Faculty. The first awards were made on the results of the examinations of 1951.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Chief Accountant to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Fifty Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

GEO. W. CROTHERS LIMITED SCHOLARSHIP

Geo. W. Crothers Limited have presented a scholarship of an annual value of $250.00, the first award being made in the Session 1951-52.

The award will be made on the recommendation of a Committee of Award consisting of the Dean of the Faculty, two representatives of the Faculty Council and a representative of the donor on the following basis:

(*a*) The award is open to students registered in the Third or Fourth Years in this Faculty.

(*b*) Consideration will be given to academic achievement, financial need, extra-curricular activities and such other factors as may be appropriate.

(*c*) The scholarship is tenable with other awards.

(*d*) Application must be made to the Secretary of the Faculty not later than 1st November.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Course in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

KENNECOTT COPPER CORPORATION SCHOLARSHIP

The Kennecott Copper Corporation offers a scholarship of a value of $1000.00 annually to a student who has completed three years of the course in Mining Engineering or, in an exceptional case, to a graduate student proceeding to the Degree of Master of Applied Science in Mining Engineering. The award will be made on the following basis.

(*a*) proficiency in engineering studies.
(*b*) leadership, willingness, co-operativeness, initiative and ambition.
(*c*) ability to direct and stimulate others.
(*d*) good health and physique.

The first award was available in 1948.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year. A gift of books accompanies the medal.

ONTARIO CHAPTER, AMERICAN SOCIETY FOR METALS PRIZE

The Ontario Chapter, American Society for Metals offers a prize of $50.00 to a student registered in the graduating class in Metallurgical Engineering. The award is made annually, commencing 1951, on the recommendation of the staff in the Department of Metallurgical Engineering, primarily on the basis of a Thesis on either physical or extractive metallurgy. The prize may be held along with any other award.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgy Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

R.C.E. MEMORIAL SCHOLARSHIP

The Memorial Fund Committee of the Royal Canadian Engineers has established the R.C.E. Memorial Scholarship of a value of One Hundred and Twenty-five Dollars, open to students who have successfully completed their second to last year in the Faculty of Applied Science and Engineering or the School of Architecture. A candidate must be a member in good standing of the Canadian Officers' Training Corps and have successfully completed one summer season's training. Selection is made on the basis of academic standing and of qualities of leadership.

Application forms may be obtained at the C.O.T.C. Orderly Room, 119 St. George St.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special enphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

MASSEY-HARRIS COMPANY LIMITED SCHOLARSHIPS

The Massey-Harris Company Limited has established two scholarships each of an annual value of $250.00, to be awarded on the recommendation of the Council of the Faculty of Applied Science and Engineering to students registered in the Fourth Year of the Courses in Mechanical Engineering or Engineering and Business. In making the award academic achievement, financial need, extra-curricular activities and such other factors as may be deemed appropriate will be taken into consideration.

Application should be made to the Secretary of the Faculty not later than 15th October.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric

Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power developments at Shipshaw on the Saguenay River, which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer for award in the Province of Ontario two out of ten of the Rhodes Scholarships for Canadians, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year given conditionally at Oxford or elsewhere abroad may be authorized in proper cases.

Each candidate must be a British subject with at least five years domicile in Canada and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year *for* which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

A candidate may apply either for the province in which he has his private home or residence, or for the province in which he has taken his university course.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or

personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., K.C., 5 Rosedale Road, Toronto 5, General Secretary for the Rhodes Scholarships in Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey or the appropriate provincial secretary on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be ineligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Dean MacFarlane, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

McCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award.

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time as recommended by the School of Engineering Research, to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $1,200.00 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $1000 for a research in some field of pure or applied science; an additional amount of $200 is available for special equipment and supplies. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four Graduate Research Fellowships now having a potential value of $3,750.00 each ($1,250.00 a year payable in Canadian funds for a maximum of three years). The fellowships are open to graduates of any approved University in Canada and are offered for graduate study leading to a Master's or Doctor's degree in the fields of Chemistry and/or Engineering (two fellowships), Geology (one fellowship), and Economics or Industrial Relations (one fellowship). Nomination of students for the fellowships is made by the University—such nominations to be received by Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st of each year. Nomination forms and information as to the terms of the fellowships are obtainable at the Registrar's Office.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships of the value of $1,500 each are open to graduates of any recognized university who propose to pursue advanced study and research in any branch of Engineering in the University of Toronto.

Forms of application may be obtained from the Secretary of the School of Graduate Studies. These should be returned together with a transcript of academic record and an outline of the proposed study and research not later than March 1st.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIP

The Spruce Falls Power and Paper Company Limited has established the Arthur Hays Sulzberger Fellowship for the encouragement of research in the Faculty, of an annual value of $1,000.00. It is open to graduates of the University of Toronto or of other recognized universities,

but is restricted to Canadian Citizens. Application should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

BABCOCK-WILCOX AND GOLDIE-MCCULLOCH LIMITED FELLOWSHIP

Babcock-Wilcox and Goldie-McCulloch Limited have established a Fellowship of the value of $1500.00 annually to be awarded preferably for research in connection with a subject relating to Mechanical Engineering. The holder of the fellowship must be registered in the School of Graduate Studies of this University proceeding to an advanced degree. The award is made on the recommendation of the Council of the Faculty of Applied Science and Engineering and is open to graduates in engineering of any recognized University. The first award was made for the Session 1951-52.

Application must be made to the Secretary of the School of Graduate Studies not later than 1st March. The application must be accompanied by an official transcript of the applicant's undergraduate record and may outline a proposed study and research.

THE ATHLONE FELLOWSHIPS

His Majesty's Government in the United Kingdom have established a number of fellowships to be awarded annually to enable Canadian engineering graduates to take postgraduate training in the United Kingdom. These became available in 1951 when five fellowships were open to graduates of the University of Toronto immediately after graduation. Additional fellowships are for award to graduates who have already spent some time in industry. The fellowships cover costs of transport, fees and maintenance and are normally tenable for a period of two years. They may be utilized for (*a*) works training in industry, (*b*) postgraduate university study, or (*c*) a combination of these. Candidates must be Canadian citizens or British subjects normally resident in Canada and should preferably be less than 27 years of age. Further information and application forms may be obtained from the Secretary of the Faculty.

THE UNIVERSITY OF MANCHESTER TORONTO FUND

The University of Manchester has accepted the gift of a sum of £1,699 from a Committee representing the parents of children who during the war were evacuated to Toronto and other places in Canada. The capital and any income arising therefrom will be used to make grants to Canadians wishing to conduct post-graduate studies and/or research in the University of Manchester, preference being given to students who have graduated from the University of Toronto. The total amount of grant or grants to any student will not exceed £100. Applications must be submitted to the Registrar of the University of Toronto on or before January 1st of the year in which the applicant wishes to enter the University of Manchester, together with transcripts of undergraduate and graduate record and outlines of the post-graduate studies and/or research to be followed at the University of Manchester.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham. The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are

requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. To be eligible, students must have obtained not less than sixty-six per cent. at their last annual examination. Further information may be obtained from the Secretary of the Faculty.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretarv of the Faculty.

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.
S.A.E.—Canadian Section Loan Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual

income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SOCIETY OF AUTOMOTIVE ENGINEERS—CANADIAN SECTION LOAN FUND

The Society of Automotive Engineers—Canadian Section has established a loan fund of $300.00 in the Faculty of Applied Science and Engineering. Preference is given to students in good scholastic standing and engaged in studies relative to the automotive and aircraft industries, and to students in fourth, third and second years in that order. Particulars may be obtained from the Secretary of the Faculty.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminar courses, and private studies intended for advanced students engaged in research work. The University Library maintains also reserved book reading-rooms in University College and in the Economics Building.

During term the hours, except on Sundays and holidays, are:

University Library............................8.45 a.m. to 10.00 p.m.
(5 p.m. on Saturdays)

University College reading-room.................8.45 a.m. to 10.00 p.m.
(12.30 p.m. on Saturdays)

Reading Room, Economics building..............9.00 a.m. to 5.00 p.m.
(Closed on Saturdays)

During the summer and winter vacations, the Library building is open from 9 a.m. to 4 p.m. (except on Saturdays and Sundays); and the two reading-rooms are closed.

Books in general demand may not be taken out of the Library until 3 p.m., when they are lent for the night, to be returned by ten o'clock the following morning. On Friday afternoons, these books are lent for the week-end. Books in the main library not in general demand may, on application, be borrowed for a longer period.

Many of the departments of the University, especially those that maintain laboratories or are at some distance from the University Library, have "departmental libraries"; but these, though authorized by the Library Committee of the Senate, are under departmental control, and books from the main Library are transferred to them at the discretion of the Librarian of the University. The regulations governing the use of books in the departmental libraries are determined in each case by the department concerned, and vary from one department to another. Transfer of a particular book to one of these libraries is indicated in the public catalogue in the main Library.

In the University Library students of the humanities possess an extensive laboratory. It is not only a storehouse, but a workshop in which selected materials are indexed and arranged so as to be useful. The Library does not attempt to supply textbooks; but for general and specialized reading it possesses more than half a million volumes. It subscribes to about six thousand periodicals, and is a Canadian depository for United Nations publications.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical, Engineering, Mechanical, Mining and Wallberg Buildings for convenient reference.

These departmental libraries are situated as follows:

Applied Physics	Room 22, Engineering Bldg.
Chemical Engineering	Room 2001, Wallberg Bldg.
Civil Engineering	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering	Room 25, Electrical Bldg.
Geological Sciences	Room 74, Mining Bldg.
Mechanical Engineering	Room 135, Mechanical Bldg.
Metallurgical Engineering	Room 37, Mining Bldg.
Mining Engineering	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment fo· the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit

machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle 400,000-lb. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 ft. in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-lb. screw power universal testing machine, taking beams 18 ft. in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-lb. screw power universal testing machine, a Riehle 20,000-lb. screw power universal testing machine, an Olsen 20,000-lb. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-lb. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-lb. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-lb. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-lb. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure—apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

The Mining Engineering laboratories are located in the Mill Building which is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part of the third are occupied by the assaying

laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storeroom.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similiarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated-pier.

Modern equipment for the physical detection and estimation of radioactivity in ores occupies a special room on this floor.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORIES

The rock crushing section includes gyratory, jaw and rolls crushers, disc grinders and screening equipment. The grinding section includes ball and rod mills of several sizes together with working models of modern classifiers. Gravity concentration is demonstrated on Wilfley and Deister tables, corduroy blankets, jigs, sink and float unit, and a Humphrey spiral.

Flotation of ores is performed with either laboratory testing machines or a complete circuit including grinding unit, classifier, conditioner and a six cell Fahrenwald Sub A flotation machine, a pilot Wilfley and a thickener Another laboratory is fully equipped with testing equipment for grinding, flotation, cyanidation, filtration and magnetic separation tests.

There are also space and equipment for the teaching of the principles of sampling materials in various states of division or suspension.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

This laboratory is located on the ground floor of the Mechanical Building and comprises an experimental boiler house and a large engine room with special test-bays for internal combustion engines.

The equipment includes: three experimental boilers with stokers and auxiliaries; an injector test-rack with several injectors of different type; impulse steam turbine with hydraulic dynamometer, condensing plant and auxiliaries; reaction type steam turbine with electric dynamometer, condensing plant and auxiliaries; uniflow steam engine; large low speed steam engine with condensing plant; tandem-compound steam engine with condensing plant; two small high speed back pressure steam engines; cross-compound steam driven air compressor; low speed gas engine; medium speed compression-ignition oil engine; hot-bulb ignition two-stroke oil engine; industrial type high speed gasoline engine; two automotive type gasoline engines; automotive type compression-ignition oil engine; four variable compression engines suitable for research and testing of fuels; fuel injection spray characteristics test bench.

Prony brakes, rope brakes, hydraulic dynamometers, engine indicators, steam calorimeters, air measuring equipment, fuel measuring equipment, exhaust gas analysis apparatus, and instruments such as gauges, thermometers, thermocouples, pyrometers, potentiometers, electric metering equipment, etc., are provided where required.

FUEL TESTING LABORATORY

This laboratory is located on the second floor of the Mechanical Building. Facilities are provided for both undergraduate and research study. The equipment includes precision balances, drying ovens, electric furnaces, a peroxide bomb calorimeter, an oxygen bomb calorimeter,

flow calorimeter for gaseous fuels and flow calorimeter for liquid fuels, fuel injection spray characteristics research and test equipment, octane rating testing equipment.

HEAT TRANSFER LABORATORY

The laboratory is arranged on three floor levels in the Mechanical Building, with fluid circulating systems serving all levels through a vertical pipe hatch. Facilities are provided for both undergraduate and research study in the several mechanisms of heat transmission. The equipment includes 24″ and 8″ guarded hot plates and 2″, 3″ and 8″ guarded pipe apparatus for thermal conductivity determinations, together with complete control and measurement recording systems; a multi-purpose constant temperature room, 12′ × 12′ × 9′, providing accurately controlled atmospheres at temperatures from − 30°F. to + 120°F.; Inglis concentric fin-tube, and shell-and-tube industrial type heat exchangers specially fitted for experimentation, together with controls and auxiliaries; and a gas-fired boiler system supplying steam for rating tests of radiators and convectors.

REFRIGERATION AND AIR CONDITIONING LABORATORY

This laboratory is located on the third floor of the Mechanical Building. Refrigeration equipment includes an ammonia cold storage plant, freon systems for air conditioning, deep freeze unit for temperatures to 120 degrees below zero Fahrenheit, and small demonstration refrigerators of both compression and absorption type. Air conditioning equipment includes fans of centrifugal and axial flow types, steam and water heating coils, water and refrigerant cooling coils, water spray and wet cell type air washers for humidification and dehumidification, and three systems of air ducts for the study of air flow. Also various types of heat exchangers are used with both refrigeration and air conditioning equipment.

HYDRAULIC LABORATORIES

The Hydraulic Laboratories, located in the Mechanical Building are designed and equipped to provide adequate facilities for instruction and research in all phases of fluid mechanics. The laboratories are divided into two main sections—that in which turbines, pumps, pipe flow problems, fluid measurements, etc., are carried out and a new laboratory in which open channel flow problems and similar allied subjects will be attacked.

(a) The first laboratory is located in the older wing of the Mechanical Building, occupying two floors, each of 40 ft. x 112 ft. area. In this laboratory teaching and research are carried out in several branches of hydraulics. Among the subjects considered are the measurement of the flow of gases and liquids, friction losses in pipes and fittings, the performance of turbines, pumps, compressors and fans, with special studies such as water hammer in pipe lines and cavitation in machines.

The laboratory equipment includes five centrifugal pumps capable of supplying ten cubic feet flow per second to the laboratory supply system, a Belliss and Morcom Steam Engine driving some of these pumps, various weirs, orifices, meters, experimental pumps, a complete turbine test stand, impulse, Francis and Kaplan turbines, glass-sided channel, measuring tanks, large scales and numerous other equipment.

(b) A new Open Channel Flow Laboratory is located in the new wing of the Mechanical Building. This laboratory occupies the whole basement of the wing and is 200 ft. long by 60 ft. wide. Water is supplied by three axial flow pumps of total capacity 9000 I.G.P.M. Through a rather novel design, all of the supply pipes are carried in trenches below the floor in such a way that water may be delivered to an experiment located in any part of the laboratory and the discharge returned to the sump through troughs also located below the floor level. Constant head conditions are maintained by a head tank having 600 feet of spillway crest. A towing channel 200 feet in length is located along one side of the laboratory equipped with a light car running on steel rails. There is also a glass-sided testing flume 3 ft. wide by 3 ft. in depth, available for model testing and research.

This laboratory is designed to permit the carrying out of model tests and all experimental and teaching work on subjects such as open channel flow, wave experiments, erosion studies, hydraulic jump studies, seepage through soils, and similar work.

MECHANICAL LABORATORY

The Mechanical Laboratory, located in the west wing of the Mechanical Building, provides facilities for experimentation in Lubrication, Bearing Friction, Efficiency of Power Drives, Static and Dynamic Stress Analysis, Speed Fluctuation and Governing, Determination of Critical Shaft Speeds, Vibration Measurement and Control, Balancing, and Fine Measurements.

The Gauge Room, air conditioned by a separate system, contains a J. & L. Optical Comparator, Sheffield External and Internal Comparators, a Brush Surface Analyser, Toolmaker's Microscopes, a P. & W. Supermicrometer, a DoAll Inspection Set, Optical Flats, sets of Gauge Blocks, thread and gear measuring equipment, and an array of micrometers, verniers, and other small tools.

The laboratory is provided with standard apparatus for A.S.T.M. tests on lubricants, and special instruments such as vibrometers, tachometers, a strain-gauge bridge, amplifiers, an oscilloscope, a stroboscope, etc. Larger equipment comprises two Olsen Static-Dynamic balancing machines, a Photoelastic Polariscope, a punch press fitted with strain gauges, two single cylinder gasoline engines, and specially designed machines for the testing of belts, worm gear reducers, journal and antifriction bearings, and the calibration of speed measuring instruments.

INDUSTRIAL LABORATORY

The Industrial Laboratory is designed to give students some practical experience in the basic principles of Industrial Management. Problems are worked on a variety of phases of site selection and plant layout, with special emphasis on economic considerations. Experiments are performed to illustrate methods used in industry in such subjects as motion study, including micromotion study, time study, material handling, statistical quality control, training methods and training aids. There are seminar discussions on problems of Industrial Relations. The laboratory is also being equipped for post-graduate and research work.

MACHINE DESIGN LABORATORY

The Machine Design laboratory occupies about 3,600 square feet of floor space on the top floor of the new Mechanical Engineering Building with sufficient specially designed designed desks to accommodate over 100 students at one time. This room has excellent lighting with continuous windows on three sides, two wide north-light skylights, and fluorescent lights.

With convenient freight elevator service practically any type of machine or model can be moved into the Machine Design laboratory for demonstration, instruction, and study.

MACHINE AND WELDING SHOPS

These shops have a floor area of about 2,600 square feet on the ground floor and are serviced by a four ton freight elevator.

The machine shop equipment includes: engine lathes, a turret lathe, milling machines, shapers, drilling machines, grinding machines, saws, and an air compressor (supplying air to all laboratories). The machine tools have been selected to illustrate various types of individual motor drive, and the use of both mechanical and hydraulic table feeds.

The welding shop equipment includes an arc welding machine, and oxy-acetylene welding and cutting torches. The welding shop is partitioned off from the machine shop and is provided with a separate exhaust fan.

These shops have a fourfold purpose. (1) Demonstration of machine tools, machining and welding methods, and time and motion study procedures. (2) Research and post-graduate work in metal cutting and welding. (3) Construction of research and other special equipment. (4) Maintenance work for all laboratories.

CHEMICAL ENGINEERING LABORATORIES

The Wallberg Memorial Building houses the Department of Chemical Engineering. That part of the building occupied by the department has been especially designed and equipped for the instruction of students in chemical engineering.

The general undergraduate chemical laboratories provide facilities for all engineering students taking chemical laboratory work. There are also

rooms devoted to special instruction in fundamental chemical principles, many of which also find application in industrial laboratories; for example, polarimetry, the measurement of hydrogen-ion concentration, gas-analysis, calorimetry as applied to fuels, quantitative organic analysis, colorimetry. A full-time glass-blower not only makes the increasingly complex glass apparatus required for chemical work, but also gives students instruction in the elements of glass-blowing as a regular part of their course.

Research laboratories designed for occupancy by one or two students provide excellent facilities for graduates proceeding to the M.A.Sc. and Ph.D. degrees.

The chemical engineering laboratory is a room 56′ x 72′ running through two floors, the upper floor being in the form of grill-work over about half the area with an open well in the centre. This makes it possible to erect equipment of a small-scale industrial type. A travelling crane permits easy handling of heavy pieces of equipment. Off one corner of the laboratory there is an apparatus shaft 8′ x 12′ running through to the roof, with grill-work at each floor. This provides 65′ head-room for experimental work on certain types of operations that are becoming industrially important. The principal items of permanent equipment in the chemical engineering laboratory are a 24-plate experimental still, a triple-effect evaporator, a climbing-film evaporator, two plate and frame filter presses, a rotary filter, two heat exchangers, a vacuum drier, a gas-absorption tower, a crusher, a ball mill, a Werner-Pfleiderer shredder, a sulphonator, autoclaves for hydrogenation, a steam-heated evaporating pan, and general-purpose pumps and tanks. Undergraduates use nearly all this equipment as part of their course, studying, for example, the principles of distillation, gas-absorption, heat transfer, filtration; and carrying out small-scale industrial operations in this typical equipment. For example, they transform benzene into phenol by recognized procedures, and hydrogenate (i.e. "harden") a vegetable oil to a solid fat.

Apart from this general chemical engineering laboratory, which can be used for research purposes as well, there are three chemical engineering research laboratories, which consist of rooms 16′ x 21′ containing only the usual services. These will permit carrying out projects involving the construction of special equipment. There is also a room of about the same size containing 8 reinforced concrete cubicles for carrying out high-pressure work in autoclaves.

A machine shop 31′ x 17′ containing representative equipment provides the necessary machine-shop service to the chemical engineering laboratory in particular and to the department in general.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. Several motor generator sets are available for experiments on synchronous and induction machine. Transformers and alternating-current motors of various types; a model transmission line; a special 25-h., 22-pole, 60-cycle synchronous machine; and necessary instruments and auxiliary apparatus are available.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is

treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

ENGINEERING ELECTRONICS LABORATORY

The Engineering Electronics Laboratory, located on the top floor, is equipped for experiments on electronic applications in the industrial power frequency fields. The equipment includes cathode ray oscillographs of twin beam and conventional types, hot cathode rectifiers, pool cathode mercury arc rectifiers, thyratrons, ignitrons, photo-electric cells and the necessary auxiliary equipment such as power supplies, transformers, amplifiers, and measuring instruments. The equipment is so designed that circuits for the study of fundamental principles may be arranged easily and quickly. While typical commercial tubes and components are employed, they are used in such a manner as to give the greatest educational value rather than to illustrate finished commercial products.

METALLURGICAL ENGINEERING LABORATORIES

The laboratories occupy some 14,000 square feet of floor space in the Mining Building which is distributed between extractive metallurgy, physical metallurgy and ceramics.

The extractive metallurgy laboratories are located in two large rooms in the basement. One of these is equipped with gas furnaces for melting, heat treatment, and reduction, while the other houses the electric furnaces.

The electric furnace laboratory is fitted with the following: A 50 H.P. motor-generator set provides 60 cycle current at various voltages between 27.5 and 550. A 200 Kva transformer provides 25 cycle current at various voltages between 30 and 120. These services supply resistance furnaces of special design and also operate standard electric furnaces of arc and induction type. A 100 Kva direct arc furnace and a 15 Kva Detroit rocking furnace are available. Induction furnaces include 7.5 Kva and 15 Kw spark oscillators and a 15 Kw Northrup mercury arc oscillator. The laboratories contain outstanding equipment for conducting metallurgical reactions in vacuo and special atmospheres.

The laboratory for metallurgical analysis is well equipped to give students training in the analysis of mill and smelter products, ferrous and non-ferrous alloys, and specialized ceramic bodies. This laboratory includes a Hilger medium quartz spectrograph.

The physical metallurgy laboratories are located on the second floor. Grinding and polishing rooms include standard polishing wheels and hydraulic press for specimen mounting. The metallography laboratory is equipped with a horizontal Bausch and Lomb photomicrographic camera, research "metalloscope" and a number of desk type metallurgical microscopes.

The testing laboratory contains an Olsen universal testing machine, Rockwell hardness tester and a Tukon micro-hardness tester, etc.

There are four well-equipped dark rooms for the developing and printing of photographs and micrographs.

The atomic structure of metals can be examined by means of two Phillips X-ray Diffraction machines, which are fitted with various types of cameras (powder, back-reflection, etc.) for various uses.

The laboratory workshop is well equipped with the usual machine tools and also includes welding equipment as follows: D.C. arc, oxyacetylene, spot welder, and atomic hydrogen welder.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for reception.

UNIVERSITY SURVEY CAMP

(A) Gull Lake Survey Camp

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, and Mining Geology, as well as for other students taking special work. The country is broken and rolling,

and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

(B) Dorset Survey Camp

On account of the large number of students in Civil Engineering, accommodation at the University Camp at Minden has not been sufficient and the University has made arrangements with the Department of Lands and Forests to carry on a camp at the Forest Ranger School, 8 miles south of Dorset at the same time as the Minden Camp. During the past four years Civil Engineering students have reported at this School. This property, about 17,000 acres in extent, belongs to the University and a large number of permanent buildings have been constructed by the Department of Lands and Forests with excellent accommodation which the Department has made available for students. The class has been divided between the two camps with the exception that all students taking Mining and Mining Geology report at Minden. A daily bus service operates from Lindsay to this school.

The charge for accommodation at each camp in 1952 is estimated at $2.50 per day. A copy of instructions will be distributed to each student.

Mail, telegrams,and messages should be addressed to University Survey Camp, Minden, Ontario, or to Forest Ranger School, Dorset.

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined

measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

GEOLOGICAL LABORATORIES

Facilities are available in the Department of Geological Sciences for the practical study of geology, mineralogy and palaeontology at both the elementary and advanced levels. Extensive suites of minerals, rocks and fossils are used as an illustrative adjunct to lecture courses. These include specimens typical of Canada as well as foreign material. Standard laboratory equipment such as microscopes and section cutting equipment is maintained to assist in the study of the material. There is an up-to-date library of geological and topographic maps of Canada as well as countries

outside the Dominion, and there is a draughting laboratory equipped with light tables. For advanced students there is a fully equipped modern petrological laboratory, including photomicrograph and dark room facilities, a geochemical laboratory, a laboratory equipped with apparatus for geothermometrical and geobarometrical study, and a sedimentation laboratory.

A modern mineralogical laboratory is equipped with optical and X-ray goniometers, a Berman microbalance and other apparatus for the advanced study of minerals. An extensive reference collection of standard X-ray powder patterns is available.

ROYAL ONTARIO MUSEUM

Archaeology, Geology and Mineralogy, Palaeontology and Zoology, Division of Education

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum.

The Museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free to the public on Tuesday, Thursday, Saturday, and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Museum Board all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of its own students in respect of all matters arising or occurring in or upon its respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SECTION XIV—UNIVERSITY HEALTH SERVICE

I. *Membership:* Membership in the University Health Service is obligatory for all students, with the following exceptions:

(a) Women living in residence at Victoria College, for whom the College provides its own Health Service.

(*b*) Students in the Pass Course for Teachers, in courses leading to the degrees of Bachelor of Science in Medicine, Bachelor of Science in Dentistry and Bachelor of Pedagogy; and certain graduate and occasional students.

Those for whom the fee is not compulsory may be granted membership on payment of the fee, provided this is done at the time of registration.

II. *Objective:* The objective is the preservation and promotion of the health of the students.

III *Facilities:* The Health Service maintains a close liaison with the Medical Service of the Department of Veterans Affairs.

(1) Medical Examination. By order of the Board of Governors, a medical examination by the Health Service is compulsory for:

(a) Undergraduate students in their first year of attendance at the University. This examination is to be completed within one month of registration. Thereafter, the examination is to be repeated following any serious illness or accident.

(b) Any undergraduate student who, at the previous year's examination, was placed in a Category below B, i.e. B(NS), B(NBC), D, and E.

(c) Any student, graduate or undergraduate, whose domicile is not in Canada. This examination is to be completed annually within one month of registration.

(d) Any student, graduate or undergraduate, where the Health Service has reason to believe that such an examination is necessary in the interest of the health of the student or of the public.

(e) Any student, graduate or undergraduate, annually, before participating in organized competitive athletics or required physical education. The Health Service shall have the right to debar any student on medical grounds from participating in athletics, and also to recall any athlete for examination.

An opportunity will be afforded annually for all students to have a medical check-up if they so desire.

(2) X-Ray Chest Survey for Pulmonary Tuberculosis. By order of the Board of Governors, the following groups of students

must have an x-ray examination of the chest as arranged by the Health Service:

(a) All new students.
(b) All final year students.
(c) The following students annually:
  (i) Medical students.
  (ii) Students of the School of Nursing.
  (iii) Students whose domicile is not in Canada.
(d) Dental students in their first year and last two years.
(e) Any student for whom it is considered necessary.

(3) A Clinic Service. Any student may consult a Staff Physician at the Health Service between the hours of 9 a.m. to 4.30 p.m., Monday to Friday, and 9 a.m. to 12.30 p.m. Saturday, while the University is in session.

It is essential that students should develop a sense of personal responsibility for the preservation and promotion of their own health. If they are not enjoying good health, they are urged to consult a physician at this clinic.

(4) Athletic Injury Service. The University does not accept any responsibility for injuries sustained by students while engaged in physical education classes or in University athletic activities, but through the Student Health Service, provides for treatment within the following limits Minor conditions are treated at its offices and at Hart House Surgery during certain hours. In the case of more serious injuries requiring specialist or hospital care, it will provide further treatment within the limits set out hereafter, provided such treatment is taken under the direction and care of staff retained by the Health Service. Treatment is limited to students who have paid the Health Service fee, and who suffer accidents while engaged in, and which arise out of University physical education classes and competitive athletics or physical recreational activities, other than skiing, sponsored by the University of Toronto Athletic Association, the Women's Athletic Association, and by the Hart House Squash Club. Members of the University and Interfaculty Ski Squads, if registered as such with the University of Toronto Athletic Association, are covered while skiing as members of such Squads.

In order to qualify for these benefits, it is necessary to notify the Health Service of injuries within twenty-one days of their occurrence. It shall be the student's responsibility to provide proof of his eligibility for this treatment.

Benefits. If such injuries shall necessitate within 90 days from the date of accident, any of the following benefits, the Health Service will provide:

(*a*) Hospital and Infirmary Benefits. The actual cost of confinement to a licensed hospital or a University Infirmary, but not exceeding $7.00 per day in the case of hospital and $5.00 per day in the case of Infirmary; and for a total period not exceeding ninety days in respect of any one accident to any one student.

(b) Certified Specialist Fees. The proper fees of legally qualified and certified specialists in any branch of medicine or surgery, but not exceeding the fees provided for such services in the Ontario Medical Association Schedule of Fees; and in no event exceeding $200 if such injured student is hospitalised for twenty-four or more hours, or $100 for all other cases.

(c) Miscellaneous Expenses. The amount expended but not exceeding $100 in any one case for the services of an anaesthetist, the use of an operating room, x-rays, surgical dressings or medicine, if such services and supplies shall be provided in a licensed hospital. Ambulance charges are included in the above.

(d) Dental Fees. The cost of dental x-rays and dental fees not exceeding $100 for the treatment of injury to sound, natural teeth.

(e) Other Insurance. Where a student is eligible for similar benefits under any other prepaid plan, the University Health Service shall be responsible only for that amount in excess of those other benefits and up to the limits above stated.

Exclusions. The benefits provided by the Athletic Injury Service shall not cover injuries sustained in transit to or from the specified activities. Nor shall it cover hernia or bacterial infections (except pyogenic infections which shall occur through an accidental cut or wound) or any other kind of disease. Nor shall it cover any injury caused directly or indirectly, wholly or partly, by willful misconduct or rowdyism, or by bodily or mental infirmity. Nor shall it cover any costs as the result of accident causing miscarriage, abortion, or aggravation of pregnancy.

(5) Health Education. The Health Service provides health education through individual consultations and at times by lectures on subjects related to the preservation and promotion of health.

For students living away from home who have not a private physician, the following services will, when available, be provided for a nominal additional charge. In the case of students on rehabilitation grants, these charges will be borne by the Department of Veterans Affairs.

(6) A Visiting Service. An initial visit only will be paid for advice and disposal. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) is made for this visit and is payable to the Chief Accountant.

(7) An Infirmary Service. This service is for the treatment of minor illnesses only, and is available from October 1st to May 15th, and during the actual session only. A charge of $3.00 per day, payable to the Chief Accountant, is made to cover cost of meals, nursing and routine medications.

IV. *Appointments.*

(a) *Medical Examinations.* These examinations commence immediately after Labour Day in September. The examinations are by appointment only, which may be made either by telephone or in person at the Health Service offices.

The importance of keeping and being on time for the appointment as made, cannot be over-emphasized. Undergraduate students in their initial year of attendance at the University, students whose domicile is not in Canada, and all students, graduate or undergraduate, proposing to engage in athletic activities, will be examined first. The remaining years will be offered an opportunity for this examination in succession. Examinations must be completed before March 15th.

(b) *X-Ray Examination of Chest.* The Tuberculosis Survey takes place early in the Autumn Term. Arts Men students, and all women students, make their appointments in person at their respective Health Service offices. Appointments for Men students in faculties other than Arts are made through their Class Presidents.

The *Varsity* should be carefully watched for notices relative to all appointments.

V. *Communicable Diseases.* Any student who has suffered from one of the communicable diseases must report to the Health Service prior to returning to the University.

VI. *Students Whose Domicile is not in Canada.* All such students are required to submit with their formal application, a certificate by a qualified medical practioner stating that:

(1) the student is in good health and free from contagious or infectious disease, and fit to pursue his proposed course of study at this University.

(2) In addition, an x-ray film of the chest has been made within one month of the certification, and shows no evidence of tuberculosis.

They are further warned that their registration is conditional on their passing the required health examination by the University Health Service, which includes an x-ray of the chest and which must be completed within one month of registration.

VII. *Fee:* The Health Service Fee is included in the "University Incidental Fees" and is paid at the time of registration.

VIII. *Directory:*

Directory	*Address*	*Telephone*
Health Service (Men)	43 St. George St.	MIdway 9644
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		
Health Service (Women)	43 St. George St.	MIdway 2646
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		

N.B. This office is closed during vacation periods. At these times, general information may be obtained from Health Service (Men), and those eligible for service may make an appointment to see Dr. Frances Stewart or her substitute at her private office, by telephoning KIngsdale 7537.

Hart House Surgery	Hart House	MIdway 5838
Hours Open: Monday to Friday, 5 to 6.30 p.m. (during actual session only)		local 201
Infirmary (Men)	42 St. George St.	MIdway 3017
Open October 1st to May 15th.		
Infirmary (Women)	Women's Union 79 St. George St.	KIngsdale 8163
Open October 1st to May 15th.		

Accidents which occur after 6:30 p.m. (or 1 p.m. on Saturday), or which are of a sufficiently serious nature as to require immediate hospital attendance, should be taken:

Men: To the Emergency Department, Toronto General Hospital, College St.

Women: To the Emergency Department, Women's College Hospital, 76 Grenville St.

To obtain a physician after hours call KIngsdale 8163, if no answer, call KIngsdale 1911 and ask for the University Health Service physician.

REQUIRED PHYSICAL EDUCATION—MEN

By order of the Board of Governors each man proceeding to a Bachelor's degree must obtain standing in Physical Education during the first and second years of his attendance at the University. The physical education requirements include a swimming test which must be taken before November 1st by all first year men and by men admitted to the second year from other Universities. Swimming classes are compulsory for all students who fail to pass the swimming test. Physical Education credits may be earned by participation in Gymnasium classes, swimming and water safety classes and in designated Intercollegiate and Intramural sports. All men required to take Physical Education must register at the Key Office in Hart House before October 15th.

A student who fails to meet the Physical Education requirements during his first year of attendance shall repeat the course in his second year and pay a supplemental fee of $10.00.

A student who fails to meet the Physical Education requirements during his second year of attendance shall repeat the course in his third year and pay a supplemental fee of $10.00.

A student who fails to meet any of the Physical Education requirements during the first two years of his attendance may petition the Senate, through the Registrar of the University, for permission to proceed to the next higher year. He will be required to complete all requirements in Physical Education before he is eligible to receive the Bachelor's degree. Further, he will be required to pay a $10.00 supplemental fee in each session in which he is repeating the required classes.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

REQUIRED PHYSICAL EDUCATION—WOMEN

By order of the Board of Governors each woman proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first year of her attendance at the University. The physical education requirements include a swimming test and a posture test, both of which must be taken before October 10th by all First Year Women. Swimming classes are compulsory for all students who fail to pass the required swimming test. Students requiring Individual Exercises to counteract faulty posture must attend a Posture Class. All women required to take Physical Education must register at the Physical Education office, 153 Bloor Street West, before October 3rd.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first year must take this work during the second year of her attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, a tuck-shop where light refreshments are served, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, photographic rooms, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily. Meals are served to students in the Great Hall from Monday to Saturday lunch. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, and the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of five of these (House, Library, Music, Art, and Debates) together with certain appointed representatives, sit on the Board of Stewards, the governing board of the House, which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $15.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Graduate Secretary's office for election by the Membership Committee.

Graduate students, graduates of this university resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is under the direct administration of the University of Toronto.

Control of the Theatre is vested in a Board of Syndics appointed by the Board of Governors. The purpose of the Theatre is the encouragement of Dramatic Art in all its aspects, particularly among the undergraduates of the University. The Theatre has a resident director and competent staff who are available for consultation and assistance. Their main activity is the production of a series of plays with all-student casts.

The Theatre was founded by the generosity of the trustees of the Massey Foundation, particularly the Right Honourable Vincent Massey and Mrs. Massey. Under the Massey Foundation and with the assistance of outstanding directors the Theatre has established an enviable reputation in Little Theatre activity throughout North America.

THE SOLDIERS' TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Armed Services in the World Wars of 1914-1918 and 1939-1945, the graduates erected the Soldiers' Tower at the southwest corner of Hart House. The names of the fallen are engraved in stone, on a Memorial Screen, and on tablets under the Tower.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the University. The Students' Administrative Council publishes *The Varsity, Torontonensis* and the *Students' Handbook.* It represents the students at University functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Applications for loans must be made to the General Secretary-Treasurer of the Students' Administrative Council. The maximum loan is $100.00.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The University Symphony Orchestra, University Mixed Chorus and University of Toronto Band are activities of the Council in which undergraduates of the University may participate. The Council through its Radio Committee conducts courses in announcing, script writing and casting which are for undergraduates. These are under the direction of competent instructors from the C.B.C.

Through its organizations such as the Blue and White Society and the All Varsity Revue, the Council endeavours to promote a University consciousness and loyalty amongst the undergraduate body.

The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund for students in the final two years of their courses. The fee also covers the administration costs of the Students' Administrative Council.

The Students' Administrative Council is prepared to make to ex-service personnel emergency loans pending receipt of their entitlements under the Educational Benefits provided in the Post-discharge Re-establishment Order.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

the President of the University,
seven members of the faculty, appointed by the President,
two graduates, appointed by the Athletic Advisory Board.
the Director of University Health Service, the Director of Athletics and the Financial Secretary (*ex-officio*),
five undergraduates, elected annually, from the student body,
an undergraduate representative, appointed by the Men Students' Administrative Council.

Under the authority of the Board of Governors the Athletic Directorate shall have full control of the administration of the funds of the Association, which are used in furthering the development of competitive and recreational athletics for University students.

The Directorate subject to the approval of the President is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Education available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

the President of the University,
two women members of the faculty, appointed by the President,
the Assistant Director of University Health Service in charge of Women, the Director of Physical Education for Women, and the Financial Secretary (*ex-officio*),
six women undergraduates, elected annually,
one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate also controls and administers the voluntary programme in Athletics and Physical Education available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Under the authority of the Board of Governors, the Women's Athletic Directorate administers the funds of the Association which are used to further the development of competitive and recreational athletics for undergraduate women.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.
(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.

(*f*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.
(*g*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.
(*h*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.
(*i*) The Debating Club of the Engineering Society, composed of the undergraduates in all courses.

These clubs devote themselves to subjects of special interest to their members. Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize ts purpose are study groups, worship services, forum discussions, confer-

ences, lectures, work projects, and social services in the down-town district. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the S.C.M. offices in Hart House and the Household Science Building.

ENGINEERING CHRISTIAN FELLOWSHIP

The Engineering Christian Fellowship is a group of engineering students from each branch of engineering that meet regularly to increase their knowledge and experience of the Christian Faith. They also seek to present the challenge of Christ's claims to their fellow students and to make these claims relevant to them as engineers.

The ECF is one of six such Varsity campus groups, all members of the Inter-Varsity Christian Fellowship which in its turn is part of a world-movement among students. The Engineering Christian Fellowship has been active for a number of years now and maintains a programme of daily devotions, Bible discussions, and special weekly features. Occasionally, it joins the other Fellowship groups on the campus for special series of addresses, worship services, or weekend conferences.

The Engineering Christian Fellowship seeks to encourage a wholehearted allegiance to Jesus Christ as Lord and Saviour. However, it welcomes into its Fellowship those of all views and backgrounds and seeks to demonstrate its Christian convictions in an atmosphere of friendship. Further information as to its activity is published regularly in *The Varsity* or may be secured by phoning the Inter-Varsity Christian Fellowship office at KIngsdale 4188.

UNIVERSITY OF TORONTO
UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division course was designed by the Royal Canadian Navy to provide an opportunity for suitable young men in Canadian Universities to perform officer training while they are undergraduates and prepare themselves thereby for promotion to commissioned rank in the permanent or reserve force upon graduation.

Men who are accepted are entered as Probationary Cadets in the branch for which they apply. Before February 1st of their year of joining, they are confirmed in rank as Cadets R.C.N.(R) after having successfully passed a selection board. Upon completion of their third academic year, Cadets may be promoted to Acting Sub. Lieutenants R.C.N. or R.C.N.(R). Upon graduation they are confirmed in that rank.

Cadets are trained in the Executive, Engineer, Electrical, Constructor, Supply, Ordnance, Medical, Instructor and Special Branches of the Navy. Entry to some of these Branches has as a prerequisite, training in particular academic courses.

(*a*) The Engineer Branch is open to Engineering students other than those listed in (*b*).

(*b*) The Electrical Branch is open to students in Electrical Engineering, Engineering Physics and Mathematics and Physics.

(*c*) The Constructor Branch is open to students in Civil Engineering and Architecture.

(*d*) The Ordnance Branch is open to students in Mechanical, Chemical and Civil Engineering.

(*e*) Students in Pre-Medicine or Medicine are entered in the Medical Branch. However, medical training and interneship are not taken until a Cadet has finished first medical year and one year of general naval training.

(*f*) Students in Arts and in Commerce and Finance, may be entered in the Supply Branch.

(*g*) Students in any course may be entered in the Instructor Branch but their commissions will not be confirmed until they have completed their education certificates.

(*h*) Students who do not elect to enter any of the above noted branches may enter the Executive Branch. Cadets who have completed one summer of Executive Training may elect to train for Wings Standard.

Cadets of the University Naval Training Division wear the new uniform for Cadet Officers.

Personnel of the University Naval Training Division are paid training allowance for divisional drills attended during the academic year. The total training allowance paid during the academic year is not to exceed thirty-two days' pay at $170.00 per month.

Cadets are required to take 14 weeks' training during the summer vacation. For this training they are paid $170.00 per month plus room and board, clothing and medical care.

Commanding Officer. . Lieut. Commander (E) H. U. Ross, R.C.N.(R)
Executive Officer . . . . . Lieut. Commander A. A. Wedd, D.S.C., R.C.N.(R)
Resident Staff Officer . Lieut. I. M. Townley, R.C.N.(R)

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS' TRAINING CORPS

In view of the record of the officers who received their training in the COTC before and during the Second World War, Army Headquarters looks upon the COTC, together with the Canadian Services Colleges, as the principal source of officers for the Canadian Army.

A student who completes his training in the COTC is granted a commission in the Canadian Army upon graduation from the University and may join the Active Force, if there is a vacancy, or the Reserve Force. He is, however, under no obligation to join either the Active Force or the Reserve Force but may join the Supplementary Reserve.

Training is conducted in two parts:

(*a*) Practical training—twenty weeks each summer at Active Force schools.

(*b*) Theoretical training—not more than forty lectures per session for three academic sessions.

Pay during practical training is $170.00 per month, with additional pay on completion of each theoretical lecture course. During practical training, board, lodging, clothing, and transportation to and from the Active Force school is provided.

To be eligible for COTC training, students must be at least seventeen years of age, must be Canadian citizens, British subjects permanently resident in Canada, or eligible aliens, must be physically fit, and must be following a course of study leading to a degree.

The summer training is accepted, totally in some cases and partially in others, as the practical experience required in certain University courses.

Application for training should be made in person before the end of November at the Contingent Headquarters, 119 St. George Street, Toronto.

The Contingent staff for the 1952-1953 session is:

Commanding Officer..........Lieutenant-Colonel L. S. Lauchland, E.D.
Second-in-Command..........Major A. S. Michell
Adjutant....................
Resident Staff Officers.........Major W. R. Chamberlain, M.C.
Captain F. J. Murphy

ROYAL CANADIAN AIR FORCE (PRIMARY RESERVE) UNIVERSITY OF TORONTO SQUADRON

In 1948-1949 a University Flight of the RCAF was established at the University of Toronto. Initially this Flight was organized as a university detachment of 400 Squadron—a Toronto-based fighter squadron of the RCAF (Reserve); but in 1949-1950 it became established as a separate Reserve Training Unit on strength of RCAF Station, Toronto. In 1951 the unit was raised to squadron status in the Primary Reserve of the RCAF.

The function of the University Squadron is to foster interest in the RCAF and furnish a flow of trained university students into the Regular and

Reserve Air Force as commissioned officers. Its establishment provides placement for approximately 180 undergraduates, largely but not exclusively drawn from courses in pure or applied science or medicine.

It is expected that at the commencement of the academic session 1952-1953 there will be approximately 70 vacancies in the University Squadron reserved entirely or largely for men of classes due to graduate in 1956. Students selected for these vacancies are appointed to the rank of Flight Cadet—a comparatively new officer rank, which may be thought of as that of an officer cadet. Before appointment as Flight Cadets, students are required to sign an undertaking that upon completion of their service in the Flight they will, for a period of five years, remain in the RCAF Reserves, i.e. Auxiliary, Primary or Supplementary Reserve, or will accept appointment to the RCAF (Regular) if they desire and are selected for such appointment.

While serving as members of the University Squadron, students are given winter training consisting largely of lectures during three successive academic years. The three sessions of winter training are each immediately followed by a period of summer training and employment up to a maximum of twenty-two weeks each summer. In the case of Flight Cadets selected for aircrew, this training consists of spending two summers in qualifying to "Wings" standard as navigators, pilots or radio officers, followed by a third summer on advanced aircrew training or employment. Those cadets selected for other branches spend three summers on practical training and employment at appropriate schools or other units of the RCAF. Normally on successful completion of two summers training Flight Cadets are commissioned as Pilot Officers and spend the third summer on responsible employment in their respective branches. For winter training, the pay allowed each Flight Cadet is approximately $28.00 in his first year, and $56.00 in each of his second and third years. For summer training his entitlement, for the four to five month period, is $170.00 per month plus rations and quarters valued at $65.00 per month. These rates are supplemented by certain extra allowances for those Flight Cadets who participate in winter or summer flying training.

The RCAF Orderly Room at the University of Toronto is located at 119 St. George Street, and serves as a focal point not only for affairs of the University Squadron but also for other interests of students in the RCAF. Veterans and members of graduating classes (and other interested students) may obtain information regarding full-time service in the RCAF (Regular), and file applications for appointment to such service.

In the session 1951-1952 the staff of the RCAF on the campus of the University of Toronto was as follows:

University Air Liaison Officers	W/C T. R. Loudon, VD
	W/C F. L. Hutchison
RCAF Resident Staff Officer	F/L T. W. H. Hewer
Clerk i/c Orderly Room	Lac. J. G. Machan
Commanding Officer, University of Toronto Squadron, (Primary Reserve) RCAF	S/L D. G. Allan

UNIVERSITY ADVISORY BUREAU

The University Advisory Bureau seeks to make its own contribution to the life of the University by providing within the University a neutral zone where the student may discuss in freedom and in confidence personal matters of the most fundamental importance to his successful development as a student, as a worker, as a citizen and as a fully effective person.

In keeping with this objective, the Bureau performs the following functions:—

(a) Through liaison with the University departments, the Registrars' offices and appropriate services on the campus, the Bureau furnishes information and assistance in the financial, educational and personal spheres. The Bureau, for instance, serves as a focal centre for applications to The Veteran-Students' Loan Fund and provides information on other loan facilities, including Navy, Army and Air Force Benevolent Trust Funds. Working with appropriate Registrars' offices, the Bureau helps the student to clarify details regarding entrance requirements, courses of study and related occupational goals. The Bureau is also available for consultation on personal questions involving adjustment to University life, assessment of interests, vocational direction and other matters of a similar nature; where advisable, students are referred to more specialized services.

(b) Liaison with D.V.A. The Bureau works closely with the Department of Veterans Affairs, both locally and with Ottawa headquarters, on all matters affecting the interests of ex-service students and in many ways serves as a campus clearing house for problems which might otherwise require to be referred to the Toronto office of D.V.A.

(c) Liaison with other universities. In contact with the Advisory Bureaus located at other Universities across Canada, the Bureau seeks to maintain up-to-date information on local variations in all fields significant to students—entrance requirements and application deadlines, courses available, length of training, degrees awarded, etc.

The Bureau is located at 67 St. George Street.

SECTION XVII. LODGING AND BOARD

Housing Service for Students

For students who are not accommodated in the University and College residences, the Students' Administrative Council prepares annually a list of inspected and approved rooming houses, flats, apartments and homes. This list may be consulted at the Housing office in Hart House after August 1st and throughout the session.

To meet the housing shortage in Toronto, the Students' Administrative Council has greatly expanded its Housing Service. Every effort is being made to provide accommodation for married ex-service students and for those who have children. Information may be obtained from the Students' Administrative Council's Housing Service office, Hart House.

Through this service many opportunities have been afforded students, including those students who are married to obtain lodging and board in exchange for part-time services. Students desiring this type of accommodation are asked to indicate this when they apply.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately two hundred men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. As early as possible during the summer preceding attendance at the University, each successful applicant will be notified of his assignment. He must then send to the Secretary of the Residence Committee a deposit of $5.00. Cheques or money orders must be made payable to the University of Toronto. The deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

The residence dues for the session (exclusive of the Christmas Vacation and based on 28 weeks) are $147.00 payable to the Chief Accountant as follows: $70.00 on or before the opening date of the session; $55.00 by November 30th; $22.00 by February 29th.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1951-52

Year	1	2	3	5	6	7	8	8a	9	10	11	Total
I	94	11	74	40	84	63	14	—	22	27	58	487
II	54	3	68	17	48	51	4	1	8	5	48	307
III	64	9	67	17	69	65	3	—	5	5	32	336
IV	98	14	100	28	73	82	17	6	11	9	51	489
	310	37	309	102	274	261	38	7	46	46	189	1619

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such Council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Alumni Association Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wide sphere of University graduate activities through its membership in the Alumni Association of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Alumni Association co-ordinates the activity of all the Associations and edits and publishes the *Alumni Bulletin*, which contains news items and articles of interest to all graduates. Through class Engineering Alumni Association and Alumni Association of the University the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Association of the University; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *Alumni Bulletin* and the *Toike Oike* which is published every now and then. This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Association towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *Alumni Bulletin.*

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 137. Many part-time demonstratorships are open which permit graduate work towards a degree and research assistants are also appointed annually on salary in the School of Engineering Research. This work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE

The regulations governing the Degree of Master of Applied Science (M.A.Sc.) shall be determined as follows:

1a. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

1b. Graduate students are required to perform at least one full session's work (seven months), or its equivalent, before being recommended for the degree of M.A.Sc.

1c. A candidate for the degree of M.A.Sc. must have a good academic record in his undergraduate course and must have an average mark on written examinations of at least 65 per cent in his final undergraduate year, save in exceptional circumstances.

1d. Candidates for the degree of M.A.Sc. are required to pass written or oral examinations in not less than two and not more than five subjects, in addition to the preparation of a thesis, in fulfilment of the requirements for the degree.

2. A candidate wishing to proceed to a graduate degree shall (a) register with the Secretary of the School of Graduate Studies at the beginning of

the academic year, (b) enrol in one of the departments mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him. No applications for the degree of M.A.Sc. will be accepted where it is proposed that the research work be conducted outside the university laboratories.

3. Not later than 31st October of the academic session in which the candidate expects to obtain the degree, he shall submit to the Secretary for acceptance by the Council of the School of Graduate Studies, the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1953, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical and Ceramic Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1953, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degree of Master of Applied Science.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Electrical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1952-53 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examination in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original thesis on an engineering subject in the branch in which he has applied for a degree. The thesis shall be on work in which the candidate has had professional experience.

The thesis shall preferably be in the form of an engineer's report on the design of engineering works, or on processes of manufacture and shall indicate wherever appropriate the economic considerations for the plan adopted. Candidates for the Degree of Chemical Engineer and the Degree

of Metallurgical Engineer may, if permission to prepare a thesis on actual works or processes is not obtainable, submit a thesis on general subjects, provided that the contents are applicable to the particular branch of engineering and are comprehensive of that branch to be of value in that field.

The thesis shall be of professional grade such as would be prepared by an engineer engaged in a professional capacity to report on a project, submit a design, or propose a process. The quality of the thesis will be judged by the Board of Examiners as an indication of the candidate's professional attainments.

A thesis of a solely descriptive type will not be acceptable.

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the month of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

High School Assistants' Certificates, Type A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 66% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS

A certificate authorizing to practice Land Surveying in Ontario is granted by the Board of Examiners of the Association of Ontario Land Surveyors on the basis of certain requirements set forth in The Land Surveyors' Act. The main requirements are:

(a) Three years apprenticeship with a practising Ontario Land Surveyor.

(b) Passing the intermediate examination.

(c) Passing the final examination.

(d) Completion of requirements as to fees, bond, oath, standard of length, etc.

The intermediate and final examinations are held annually in Toronto, usually in March.

Graduates of the Faculty of Applied Science and Engineering in the branches of Civil or Mining Engineering are granted a shortened apprenticeship of one year. Full details are available upon application to the Secretary, Association of Ontario Land Surveyors, 331 Bay Street, Toronto, or from the staff in Surveying and Geodesy.

DOMINION LAND SURVEYORS

Requirements for certificate to practice as a Dominion Land Surveyor are similar to those for the O.L.S. outlined above except:

(a) Apprenticeship with a Dominion Land Surveyor.

(b) Annual examinations in Ottawa and other points where there are sufficient candidates to justify arrangements, usually in February.

Full details are available from the Secretary, Board of Examiners for Dominion Land Surveyors, Labelli Bldg., Ottawa, Ontario.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	9
Mechanical Engineering	13
Engineering Physics	7
Chemical Engineering	15
Electrical Engineering	31
Metallurgical Engineering	17
Mining Geology	17
Aeronautical Engineering	16
Total	125

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FACULTY OF APPLIED SCIENCE AND ENGINEERING CALENDAR 1953-54

For reasons of economy changes have been made in the Calendar of the Faculty for the Session 1953–54.

Up to and including page 127 all changes and corrections have been made. The remainder of the material is as it appeared in the Calendar for 1952–53, and has not been brought up to date. The following sections have been omitted entirely:

- Libraries and Laboratories
- University Health Service and Physical Education
- Hart House
- Student Organizations
- Lodging and Board
- Engineering Alumni Association
- Graduate Studies

Some of this information will be issued separately by the Registrar of the University.

The following changes have been made in Section XI Medals, Prizes, Scholarships, Bursaries and Fellowships.

Page 138 The Engineering Alumni Admission Scholarship now has a value of $400.00.

Page 139 Add

J. P. Bickell Foundation Scholarships

The Trustees of the J. P. Bickell Foundation have established in the Faculty of Arts and the Faculty of Applied Science and Engineering five scholarships for students entering First Year of a value of Twelve Hundred Dollars each.

Application must be made to the Registrar by May 1st and in order to be eligible the applicant must undertake to register in a course in Mining or Geology in the Faculty of Applied Science and Engineering, or in a course in Honour Science, or Mathematics, Physics and Chemistry in the Faculty of Arts. If registering in the Faculty of Arts, the applicant must state his intention of proceeding in a course in Mining or Geology in future years.

Applicants must have obtained at the Grade XIII examinations standing satisfactory to the Committee of Award but need not obtain First Class Honours.

Each scholarship is tenable only in the First Year of the student's course. The first awards were made for the Session 1952-3.

Page 139 Add

Smith and Stone Limited Bursaries

Smith and Stone Limited, Georgetown, Ontario, have provided five Bursaries, each of a possible value of $600.00 and each payable at the rate of $150.00 per year to assist deserving students from the Georgetown High School.

The award is made annually by the Senate on the recommendation of the Council of the Faculty to a student:

(a) who attended Georgetown High School for at least 2 years and is recommended by the Principal.

(b) who has met in full the admission requirements of the Faculty, first class honours not being a requirement.

To be eligible for continued enjoyment of the Bursary the holder must maintain satisfactory academic standing but not required to obtain honour standing.

The award was offered for the first time in the Session 1952-53.

Page 141 Add

Hydro-Electric Power Commission of Ontario Scholarships in Engineering

The Hydro-Electric Power Commission of Ontario has presented three scholarships in Engineering, each of a value of $300.00 to be awarded to three students selected from among the higher ranking students in the annual examinations of the First, Second, and Third Years in any course in the Faculty, one scholarship in each year to be tenable in the Second, Third and Fourth Years respectively.

The first award was made at the annual examinations in April, 1952.

Page 146 Delete

Eastern Steel Products Limited Scholarship

This award has been discontinued.

Page 147 Add

The California Standard Company Scholarships

The California Standard Company has donated three Scholarships, two tenable in the Faculty of Applied Science and Engineering, and one in the Faculty of Arts, each of a value of $375.00. The Scholarships are awarded on the results of the annual examinations of the Third Year, and students in a number of courses are eligible. They are intended primarily to interest students in oil exploration and production.

The first award was made at the end of the Session 1951–52.

Page 147 Add

The O'Keefe's Scholarship

O'Keefe's Brewing Company, Limited has donated a Scholarship of a value of $250.00, to be awarded to the student completing the Third Year, who taking honours, obtains the highest percent of the total number of marks of his course.

The first award was made at the end of the Session 1952–53.

Page 158 Add

J. P. Bickell Foundation Bursaries

The Trustees of the J. P. Bickell Foundation have established the J. P. Bickell Foundation Bursaries in the Faculty of Arts and the Faculty of Applied Science and Engineering. An applicant in the latter Faculty must be registered in the Second, Third or Fourth Years in Mining or Geology. He must demonstrate financial need and have satisfactory academic standing.

Application must be made to the Registrar of the University.

Page 161 The amount of the Society of Automotive Engineers-Canadian Section Loan Fund is now $600.00.

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science and Engineering

1953-1954

THE UNIVERSITY OF TORONTO PRESS
1953

CALENDAR 1953

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SECTION I. CALENDAR 1953-1954

FALL TERM, 1953

July 1	*Wednesday*	Dominion Day. Buildings closed.
July 15	*Wednesday*	Last day for receiving application for supplemental examinations.
August 3	*Monday*	Civic Holiday. Buildings closed.
August 17	*Monday*	Students of the III Year, Courses 1, 2, and 9 report at Survey Camp, Gull Lake.
August 24	*Monday*	Supplemental Examinations commence.
September 1	*Tuesday*	Last day for receiving applications for admission to the I Year.
September 7	*Monday*	Labour Day. Buildings closed.
September 10	*Thursday*	Special meeting of Faculty Council.
September 17-19	*Thursday-Saturday*	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m. (Saturday 9.30 a.m. to 12 noon) at 119 St. George Street.
September 21	*Monday*	Registration in person of the II and III Years from 9.30 a.m. to 12 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building.
September 22	*Tuesday*	Registration in person of the IV Year from 9.30 a.m. to 12 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building. Dean's address to the I Year. Preliminary instruction to the I Year. Meeting of Faculty Council.
September 23	*Wednesday*	Lectures and laboratory work commence at 9.00 a.m. The opening address by the President to the students of all Faculties at 3.45 p.m., in Convocation Hall.
October 1	*Thursday*	Meeting of Faculty Council.
October 9	*Friday*	Meeting of Senate.
*October 12	*Monday*	Thanksgiving Day. Buildings closed.
November 2	*Monday*	Meeting of Faculty Council.
November 6	*Friday*	General Meeting of Engineering Society.
November 11	*Wednesday*	Remembrance Day Service at 10.45 a.m. Lectures and laboratory classes withdrawn from 10.00 a.m. to 12 noon.
November 13	*Friday*	Meeting of Senate.

December 2	*Wednesday*	Meeting of Faculty Council.
December 3	*Thursday*	General Meeting of Engineering Society.
December 11	*Friday*	Meeting of Senate.
December 18	*Friday*	Term ends at 5.00 p.m.
December 25	*Friday*	Christmas Day. Buildings closed.

SPRING TERM, 1954

January 1	*Friday*	New Year's Day. Buildings closed.
January 4	*Monday*	Spring Term begins. Mid-session Examinations commence.
January 8	*Friday*	Meeting of Senate.
January 11	*Monday*	Meeting of Faculty Council.
January 15	*Friday*	Last day for receiving the second term instalment of fees.
January 27	*Wednesday*	General Meeting of Engineering Society.
February 2	*Tuesday*	Meeting of Faculty Council.
February 12	*Friday*	Meeting of Senate.
February 19	*Friday*	Engineering Society Annual Elections.
March 2	*Tuesday*	General Meeting of Engineering Society.
March 3	*Wednesday*	Meeting of Faculty Council.
March 12	*Friday*	Meeting of Senate.
April 2	*Friday*	Meeting of Faculty Council.
April 9	*Friday*	Term ends at 5.00 p.m. Meeting of Senate.
April 14	*Wednesday*	Annual Examinations commence.
April 16	*Friday*	Good Friday. Buildings closed.
May 4	*Tuesday*	Meeting of Faculty Council.
May 14	*Friday*	Meeting of Senate.
*May 24	*Monday*	Victoria Day. Buildings closed.
May 26, 27, 28	*Wednesday,* *Thursday,* *Friday*	University Commencement.

* Or such other date as may be determined by Order-in-Council.

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Registrar . . . . J. C. Evans, B.A.

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Comptroller . . . . A. G. Rankin, B.COM. C.A.

Bursar and Secretary to the Board of Governors C. E. Higginbottom, F.C.I.S.

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Chief Accountant . . . . G. L. Court, D.F.C., B.COM., C.A.

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Miss F. H. Stewart, B.A., M.D.

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Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.

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1952–53

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J. N. P. Hume, M.A., Ph.D. — 38 Melrose Ave.
Assistant Professor of Physics

H. J. C. Ireton, M.A., Ph.D. — 76 Lonsdale Rd.
Professor of Physics

D. G. Ivey, M.A. (B.C.), Ph.D. (Notre Dame) — 16 De Quincy Blvd.
Assistant Professor of Physics

J. A. Jacobs, M.A., Ph.D.(Lond.), F.R.A.S. — 272 St. Clements Ave.
Associate Professor of Mathematics

Miss C. C. Krieger, M.A., Ph.D. — 448 Spadina Rd.
Assistant Professor of Mathematics

G. B. Langford, B.A.Sc., Ph.D.(Corn.), F.R.S.C., P.Eng.
Professor of Mining Geology — 118 Glen Road

D. J. LeRoy, M.A., Ph.D., F.R.S.C. — 605 Oriole Pkwy.
Professor of Chemistry

W. Line, O.B.E., B.Sc.(Mt. A), M.A.(Alta.), Ph.D.(Lond.)
Professor of Psychology — 34 Burnaby Blvd.

Marcus Long, M.A., Ph.D. — 209 Lawrence Ave. E.
Associate Professor of Philosophy

G. Lorentz, Ph.D.(Leningrad, Tubingen) — 32 Prust Ave.
Assistant Professor of Mathematics

D. C. MacGregor, B.A. — 32 St. Andrews Gdns.
Associate Professor of Political Economy

R. L. McIntosh, M.B.E., B.A., M.Sc.(Dal.), Ph.D.(McG.), F.R.S.C.
Associate Professor of Chemistry — 220 Glen Rd.

R. W. McKay, M.A., Ph.D. — 2 Havergal Gdn.
Associate Professor of Physics

A. MacLean, B.A. — 488 Spadina Ave.
Professor of Geology

E. W. Nuffield, B.A., Ph.D. — Thorncrest Village, Islington
Assistant Professor of Mineralogy

W. W. Moorhouse, M.A., Ph.D.(Col.) — 138 Islington Ave. N., Islington
Associate Professor of Geology

I. R. Pounder, M.A., Ph.D.(Chic.) — 19 Glen Gordon Rd.
Professor of Mathematics

R. Richmond, M.A., Ph.D. — 41 Roslin Ave.
Assistant Professor of Physics

A. Robinson, M.Sc.(Jerusalem), Ph.D.(Lond.) — 373 Winnett Ave.
Associate Professor of Mathematics

D. A. F. Robinson, M.A., Ph.D.(Chic.) — 302 Heath St. E.
Associate Professor of Mathematics

G. de B. Robinson, M.B.E., B.A., Ph.D.(Camb.), F.R.S.C.
Associate Professor of Mathematics — 20 Whitehall Rd.

L. J. Rogers, B.A.Sc., M.A. — 110 Garfield Ave.
Professor of Analytical Chemistry

G. D. Scott, M.A., Ph.D. — 77 Roehampton Ave.
Assistant Professor of Physics

F. G. Smith, M.Sc.(Man.), Ph.D. — 57 Prince Arthur Ave.
Assistant Professor of Geological Sciences

R. G. Stanton, B.A.(West.), M.A., Ph.D. — 509 Markham St.
Assistant Professor of Mathematics

W. H. Watson, M.A.(Edin.), Ph.D.(Edin.) (Cantab.), F.R.S.C.
Professor of Physics — 740 Avenue Rd.

W. J. Webber, B.A.(Camb.) — 18 Kappele Ave.
Professor of Mathematics

H. L. Welsh, M.A., Ph.D. — 112 Glencairn Ave.
Associate Professor of Physics

F. E. W. Wetmore, B.Sc.(N.B.), M.A., Ph.D. — 191 Bayview Ave.
Associate Professor of Chemistry

J. T. Wilson, O.B.E., B.A., M.A.(Camb.), Ph.D.(Princ.), F.R.S.C.
Professor of Geophysics — 29 Roxborough St. E.

SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture. On July 1, 1948, the School of Architecture was separated from the Faculty and became an independent School with its own Director and Council.

With the end of the Second World War during the summer of 1945 the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors and the President, the University leased from the Crown part of the large shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in the First Year and 1500 in the Second Year. In the 1947-48 session the enrolment at Ajax consisted of 1200 students in the First Year and 1400 in the Second Year. In the session 1948-49, 600 were registered at Ajax in the First Year and 975 in the Second Year. All other instruction was given in Toronto.

To provide for this self-contained University community at Ajax, there were 446 acres and 111 buildings. The University operated such services as central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence, in 1947-48 there were 1800 students and in 1948-49 there were 900. Student life at Ajax compared favourably with that in Toronto, excellent accommodation being provided for a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

With the completion of the Wallberg Building and the extension of the Mechanical Building, additional accommodation became available on the Queen's Park Campus, and this fact coupled with the decrease in numbers entering each year brought about the closing of Ajax on May 31, 1949.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

GENERAL

1. Candidates for admission in 1953 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

Students from foreign countries must, in addition to providing the necessary equivalent certificates, give evidence of their ability to understand lecture and laboratory courses where the English language is used exclusively, and must demonstrate their ability to use this language in both the spoken and written form, with reasonable facility. Such students are strongly advised to spend a year in Grade XIII of an Ontario Secondary School before seeking admission to this Faculty.

3. Requirements for applicants presenting Ontario certificates.

Secondary School Graduation Diploma

No subjects are definitely prescribed, but the diploma must show credit in English and History, and in four of the optional subjects.

Grade XIII

Standing is required on nine examinations as follows:

English:	Literature	
	Composition	
Mathematics:	Algebra	
	Geometry	
	Trigonometry	
Science:	Chemistry	
	Physics	
One of:	French	*Authors and Composition*
	German	
	Greek	
	Italian	
	Latin	
	Spanish	

To be admitted a candidate must have an average of not less than Second Class Honours on at least five of the nine examinations on which standing is required.

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are advised to select German as one of the admission subjects.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate, generally known as Junior and Senior Matriculation respectively, may be accepted in so far as they meet the admission requirements of the University of Toronto in subjects and percentages and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

QUEBEC

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

MANITOBA, SASKATCHEWAN, ALBERTA

Junior (Grade XI) and Senior (Grade XII) Matriculation certificate.

BRITISH COLUMBIA

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

NEW BRUNSWICK, NEWFOUNDLAND, NOVA SCOTIA, PRINCE EDWARD ISLAND

Junior and Senior Matriculation Certificates of the Common Examining Board or of their respective Departments of Education. Second and Third Year Certificates of Prince of Wales College are also accepted from Prince Edward Island.

GREAT BRITAIN

The Oxford and Cambridge Joint Board School certificate, or equivalent, indicating "Credit" or better standing in English Language and Literature, "Advanced" or "Additional" Mathematics, Physics and Chemistry (not general science), and a foreign language.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 7th to 23rd (Saturdays September 12th and 19th, 9 a.m. to 12 noon), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

Schedule of Fees

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
I-IV	$450	$41	$491	$266	$228
Women					
I-IV	$450	$23	$473	$248	$228

*The Academic Fee includes the following fees:—
Tuition; Library and Laboratory Supply; one Annual Examination; Laboratory Fee; Physical Education; and Degree

†These Incidental Fees include the following fees:—
For men—Hart House; Students' Administrative Council; Athletic; Health Service; Engineering Society; Faculty Athletic Association.
For women—Students' Administrative Council; Athletic; Health Service; Engineering Society.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

SUMMARY OF STUDENTS' EXPENSES

11. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 25
2. Board and Lodging, per week.................. $15 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8),
Applied Geology (Course 9),
Aeronautical Engineering (Course 10),
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the above courses.

3. The courses extend over four academic years. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Electrical Engineering, and Applied Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering may proceed to post-graduate and professional degrees. The post-graduate degrees are M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and Scholarships for graduate students are available in limited number as shown on page 135. Many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked

with the graduate courses and with the work of the School of Engineering Research (page 29).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the postgraduate degrees, Master of Applied Science, and Doctor of Philosophy, see the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (see subject 690.)

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above-mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	284	–	9	–	6
Hydraulics, Elementary	447	1	–	–	–
Least Squares	494	–	–	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Education	640	–	2	–	2
Practical Astronomy	200	1	–	2	–
Practical Experience	690	–	–	–	–
Surveying	714, 716	1	–	1	3

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Cements and Concrete	35, 44	1	3	1	–
Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	297	–	9	–	9
Business	310	–	–	1	–
Construction Surveying	718	–	–	2	–
Control Surveys and Mapping	201	–	–	1	–
Differential Equations	507	1	–	1	–
Engineering Geology	382, 383	2	1	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Machinery	463, 464	2	3	–	–
Modern World History	324	2	–	–	–
Photogrammetry	75	1	–	–	–
Physical Metallurgy	546	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Students in Civil Engineering are required to state not later than June 30th following the completion of their Third Year the options they desire to pursue in the Fourth Year. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

Fourth Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Law	314	1	–	–	–
Hydraulics	445, 446	2	3	2	3
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Municipal Administration and Contracts	216	2	–	–	–
Philosophy of Science	326	2	–	–	–
Practical Experience	690	–	–	–	–
Profession of Engineering	327	–	–	½	–
Sanitary Engineering	214, 215	1	3	1	3
Thesis	730	–	–	–	1
Transportation Engineering	217	1	–	1	–
And either of the following groups of subjects:					
Group A					
Mechanics of Materials	38	–	3	–	3
Reinforced Concrete	41, 37	1	1½	1	1½
Soil Mechanics and Foundations	40, 50	2	–	1	3
Structural Design	43, 299	2	3	1	3
Theory of Structures	36, 37	2	1½	2	1½
Group B					
Adjustment of Observations	523	–	–	–	3
Astronomy	202, 203	1	3	–	–
Geodesy	204, 205	–	–	2	3
Photogrammetry	77, 78	2	3	1	3
Structural Engineering	46, 300	2	–	2	3
Survey Camp	721	–	–	–	–
Town and Regional Planning	218, 219	2	3	–	–

MINING ENGINEERING

(Course 2)

The course in Mining Engineering provides a broad training in the fundamentals of engineering.

The graduate is therefore well prepared to enter any of the many phases of the mineral industry such as the exploration and development of new mineral areas, the mining of mineral deposits by both surface and underground methods, and the milling and metallurgical treatment of the ores and products. The field of the engineer in the mining of precious metals, copper, lead, zinc and nickel in Canada is now augmented by the production of iron, titanium and uranium. Engineering is also increasingly important in the mining and treatment of industrial minerals such as asbestos, limestone and gypsum. Moreover, the expanding world market for mineral products is necessitating the utilization of ore deposits which require the application of the most advanced technological methods.

The course in Mining combines in well balanced proportions, studies in the fields of mathematics, geology, chemistry, structures, mechanics, electricity, metallurgy, and economics and business, together with courses having particular reference to mining. In view of the large proportion of mining graduates employed in production and supervision, the administrative viewpoint is emphasized throughout the course.

With such diversified training, the Mining Engineer is capable of successful participation in all branches of industry and commerce.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 275	2	1	2	1
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	4	–	5
English	610	2	–	2	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining	165	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	691	–	–	–	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	3	–	3
Chemistry	224	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Problems and Drawing	285	–	6	–	6
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	3
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Education	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	–	2	2
Survey Camp	717	–	–	–	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	–	1	6
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Cements and Concrete	35	1	–	1	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	298	–	–	–	3
Hydraulics	440, 441	2	1½	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399	2	–	2	–
Mineral Dressing	180, 182	2	–	2	6
Mining	168	2	–	–	–
Mining Laboratory	169	–	5	–	–
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	691	–	–	–	–
Structural Geology	397, 398	1	3	1	3
Summer Essays	192	–	2	–	–
Survey Camp	720, 409	–	–	–	–

Fourth Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Glacial Geology	384, 412	1	1	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Operation and Management	170, 172	2	2	2	6
Mine Ventilation	175, 176	2	3	–	–
Mining Geology	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Ore Dressing	183, 184	1	6	1	–
Physical Metallurgy	549	1	–	1	–
Practical Experience	691	–	–	–	–
Precambrian Geology	403	2	–	–	–
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	2	–	–	–
Thesis	731	–	5½	–	6

MECHANICAL ENGINEERING

(Course 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similiar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

The Calendar of the School of Graduate Studies should be consulted or details.

Graduate work leading to an advanced degree in the administrational or business aspects of engineering is also available in the Department of Mechanical Engineering. The thesis subject chosen for this purpose must be in the technological field and intending applicants are advised to obtain the approval of the Head of the Department of Mechanical Engineering before selecting their thesis topics.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	2	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	1½
Calculus	491	2	–	2	–
Dynamics	22	–	–	2	–
Economics	311	2	–	2	–
Electricity	338, 334	2	3	–	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	286	–	6	–	6
Heat Engines, Elementary	420	–	–	2	–
Mechanical Engineering	461, 480	2	3	2	3
Mechanics of Materials	23, 31	2	3	2	–
Physical Education	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines	465, 466	3	–	3	–
Treatment of Technical Data	449	–	–	3	–

Third Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Business	310	–	–	1	–
Differential Equations	507	1	–	1	–
Electronics	345, 346	2	1½	–	–
Electrical Machines	377, 378	2	1½	2	3
Elementary Structural Engineering	29, 298	1	3	1	3
Heat Engineering	422	2	–	2	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	–	2	3
Machine Design	467, 468	2	6	2	6
Modern World History	324	2	–	–	–
Physical Metallurgy	532	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	692	–	–	–	–

Fourth Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Law	314	1	–	–	–
Heat Engine Laboratory	426	–	5	–	5
Heat Power Engineering	424	2	–	2	–
Physical Metallurgy II	547, 548	1	–	1	1½
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	–	1	–
Internal Combustion and Air-Craft Engines	425	1	–	1	–
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Practical Experience	692	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	3	–	–
Thesis	732	–	1	–	3

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 130 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 114.

GRADUATE STUDY

Graduates of this University, or of another University of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students with the necessary qualifications wishing to pursue further studies, may proceed to the M.A.Sc. and PH.D. in the Departments of Engineering Physics, Electrical Engineering, Mechanical Engineering, Aeronautical Engineering, Metallurgical Engineering or, to the M.A. and PH.D. in the Department of Physics.

The requirements and programme will be arranged through the Department concerned.

For further information see the Calendar of the School of Graduate Studies.

First Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3	–	3	–
Analytical Geometry	503	2	–	2	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	279	–	3	–	3
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	3	4	3	4
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry of Space	506	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits	354, 356	2	1½	2	1½
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	2	–	–	–
Physics Laboratory	655	–	6	–	3
Physical Education	640	–	2	–	2

Third Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Electronics	366, 379	2	–	2	3
Machine Design	471, 472	1	3	1	3
Modern World History	324	2	–	–	–
Physical Laboratory	659	–	3	–	3
Physics of Solids and Fluids	656	1	–	1	–
Political Science	323	–	–	2	–
Thermodynamics and Kinetic Theory	657	3	–	3	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5e Electricity					
Electrical Machines	377, 378	2	3	2	3
Physical Metallurgy	549	1	–	1	–
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Geometrical Optics	660, 661	1	3	1	–
Physical Metallurgy	549	1	–	1	–
Option 5g, Geophysics					
Engineering Geology	382, 383	2	1	2	2
Physical Metallurgy	549	1	–	1	–
Option 5t, Thermodynamics					
Heat Engineering	422, 423	2	3	2	3
Hydraulics	450	1	–	1	–
Physical Metallurgy	549	1	–	1	–
Option 5m, Physical Metallurgy					
Physical Metallurgy	536, 537	2	3	2	3

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5e, Electricity					
Acoustics	97, 98	2	1½	–	–
Atomic Physics	663	3	–	3	–
Circuit Analysis	351	2	–	2	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Engineering Electronics	357, 358	2	1½	1	1½
Transmission at Low and High Frequency	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Ultra-High Frequency Communication	371, 372	–	–	2	1½
Option 5s, X-Rays and Spectroscopy					
Analysis of Materials by Spectrographic and X-Ray Methods	669	1	–	1	–
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	2	–	2	–
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	9	–	9
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5g, Geophysics					
Atomic Physics	663	3	–	3	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 672	2	6	2	6
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Deposits	399	2	–	2	–
Mining Geology (Part)	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	397, 398	1	3	1	3
Thesis Seminar	733	–	–	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics	89, 90	2	3	2	6
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Photometry and Illumination Design	95, 96	2	3	2	6
Physical Laboratory	674	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5t, Thermodynamics					
Atomic Physics	663	3	–	3	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Machines	377, 378	2	3	2	3
Heat Engineering Laboratory	426	–	6	–	6
Heat Power Engineering	430	1	–	1	–
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	–	1	–
Machine Design	478	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	3
Vibration Engineering	99, 100	1	3	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5m, Physical Metallurgy					
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–
Operational Methods	364	2	–	2	–
Physical Metallurgy	543, 544	2	3	2	3
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	6	–	6
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(COURSE 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more useful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical literature. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Chemical Engineering is required to submit satisfactory evidence of having had 800 hours' practical experience. (See subject 694).

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 280	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 280	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	280	–	6	–	3
English	610	2	–	2	–
General Physics	676, 677	3	3	3	3
Physical Education	640	–	2	–	2
Practical Experience	694	–	–	–	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	229	–	–	–	–
Calculus	491, 287	2	1½	2	1½
Chemical Laboratory	232	1	9	–	8
Economics	311	2	–	2	–
Electrical Engineering	375, 376	2	3	2	3
Industrial Chemistry	230	3	–	–	3
Inorganic Chemistry	231	2	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234	–	–	3	–
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	694	–	–	–	–

Third Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	242, 243	2	3	2	6
Chemical Theory	240	2	–	2	–
Differential Equations	507	1	–	1	–
Electrochemistry	246, 247	2	1½	–	–
Heat Engines, Theory	431, 423	2	–	–	3
Industrial Chemistry	241, 249	1	6	3	–
Modern World History	324	2	–	–	–
Organic Chemistry	244, 245	2	6	2	9
Political Science	323	–	–	2	–
Practical Experience	694	–	–	–	–
Public Speaking	319	1	–	1	–

Fourth Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	2	2	2	2
Chemical Engineering Thermodynamics	256	2	–	2	–
Chemical Laboratory	251	1	11	–	–
Fluid Mechanics	452, 453	2	3	–	–
Industrial Management	318	1	–	1	–
Machine Design	479, 470	2	–	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Organic Chemistry	257	1	–	1	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Public Speaking	319	1	–	1	–
Thesis	734	–	3	–	17

ELECTRICAL ENGINEERING

(COURSE 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

For the degree of Master of Applied Science at least one year of full-time study is required. From one-half to two-thirds of this time is devoted to lecture subjects in advanced studies chosen according to instructions contained in the Calendar of the School of Graduate Studies. The remainder is devoted to a research project for which a thesis must be submitted.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	2	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491, 288	2	3	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	2	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Education	640	–	2	–	2
Practical Experience	695	–	–	–	–

THIRD YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Problems	335	–	2	–	4
Electrical Laboratory	344	–	3	–	3
Electronics	337	2	–	2	$1\frac{1}{2}$
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	3	2	–
Machine Design	475, 468	2	–	2	3
Mathematical Applications in Electricity Engineering	336	2	–	2	–
Modern World History	324	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	–	–	2	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	4½	–	1½
Electrical Problems and Seminar	359	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	1½	1	1½
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	2	–	2	–
And one of the following groups of subjects:					
Group A					
Acoustics	82, 83	–	–	2	1½
Communications II	362, 363	–	–	3	3
Ultra-High Frequency Communications	371, 372	–	–	2	1½
Group B					
Alternating-Current Machinery II	369, 370	–	–	2	1½
Electric Power Systems	373	–	–	2	2
Illumination	93, 94	–	–	2	3

METALLURGICAL ENGINEERING

(Course 8)

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

Both physical and extractive metallurgy are based upon the sciences of chemistry and physics. It is believed that a wider knowledge of the basic sciences will bring to the student a readier appreciation of the technical problems with which he will be later confronted and a greater facility in their solution. To achieve this end, greater emphasis is placed upon physics and chemistry in the earlier years of the course. It follows that this course will be of greater value to students who have obtained a good standing in mathematics and science. In addition to instruction in extractive and physical metallurgy, engineering subjects are provided to give a general knowledge of mechanics of materials, machine design, etc. The course includes the non-technical subjects, such as Economics and English, which are common to all courses in the Faculty.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical Metallurgy courses cover the structure and properties of alloys, including microscopic, x-ray and mechanical methods of investigation.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 113.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 280	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 280	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	280	–	6	–	3
English	610	2	–	2	–
General Physics	676, 677	3	3	3	3
Physical Education	640	–	2	–	2

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225,228	1	–	1	6
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Inorganic Chemistry	231	2	–	1	–
Mechanics of Materials	23,31	2	3	2	–
Metallurgy	530	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2
Physics Laboratory	655	–	3	–	6

Third Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Differential Equations	507	1	–	1	–
Electrical Engineering	375, 376	2	3	2	3
Electrochemistry	246, 247	$1\frac{1}{2}$	3	–	–
Metallurgical Problems Laboratory	531	–	2	–	2
Metallurgical Theory	533	2	–	2	–
Mineral Dressing	180	2	–	2	–
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Principles of Extractive Metallurgy	534, 535	2	3	1	6
Principles of Physical Metallurgy	536, 537	2	3	2	3

Fourth Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgical Theory	550	1	–	1	–
Metallurgical Problems Laboratory	540	–	2	–	2
Metallurgy Laboratory	541	–	6	–	–
Modern Political and Economic Trends	325	–	–	$1\frac{1}{2}$	–
Non-Ferrous Production Metallurgy	542	2	–	2	–
Ore Dressing	182, 183	1	–	1	6
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	543, 544	2	6	2	3
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	736	–	4	–	7

APPLIED GEOLOGY

(COURSE 9)

The course in Applied Geology is designed for those who wish to enter the field of applied geology. It provides a training in the fundamentals of the geological sciences, and a graduate in this course will be suitably trained to enter any of the branches of geology such as mining geology, engineering geology, petroleum geology, or field and exploration work for mining and oil companies.

The first year of the course in Applied Geology is identical with that in Mining Engineering. In the remaining years, while the emphasis is on geology, instruction is also given in the allied engineering fields. In this way the student in Geology is given a basic engineering training and an understanding of the extractive industries of mining and metallurgy.

The geological courses in the first and second years cover the general fields of physical geology, historical and stratigraphic geology, and minerals and rocks. The third and fourth years are spent in concentrated work on specialized topics as ore deposits, petroleum and structural geology, palaeontology, microscopic study of rocks and ores, Precambrian geology, glacial geology, mining geology, geology of Canada, and geophysics.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Applied Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a M.A.Sc. or Ph.D.

Work for such degrees will include the preparation of a thesis on an approved subject, together with the study of advanced courses.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 275	2	1	2	1
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	4	–	5
English	610	2	–	2	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining	165	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	696	–	–	–	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	3	–	3
Chemistry	224	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Problems and Drawing	290	–	3	–	3
Geological Field Trips	410	–	–	–	–
Heat Engines, Elementary	420	1	–	–	–
Historical and Stratigraphical Geology	393, 394	2	2	2	2
Mechanics of Materials	23, 31	2	–	2	1
Mineralogy and Lithology	386, 387	2	2	2	2

SECOND YEAR SUBJECTS COURSE 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Physical Education	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	–	2	2
Survey Camp	717	–	–	–	–
Theory of Measurements	190	1	–	–	–

THIRD YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Elementary Geochemistry	385	2	–	2	–
Geological Field Trips	411	–	–	–	–
Metallurgy	530	1	–	–	–
Mineral Deposits	399, 400	2	3	2	3
Mineral Dressing	186	2	–	–	–
Mining	168	2	–	–	–
Modern World History	324	2	–	–	–
Palaeontology	395, 396	2	2	2	2
Petrology	391, 392	3	2	2	2
Political Science	323	–	–	2	–
Practical Experience	696	–	–	–	–
Structural Geology	397, 398	1	3	1	3
Survey Camp	720, 409	–	–	–	–

Fourth Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mineralogy	388	–	2	–	2
Engineering Economics	313	–	–	1	–
Geology of Canada	401	1	–	1	–
Geological Field Trips	412, 413, 414	–	–	–	–
Geophysics	671, 673	1	3	1	3
Glacial Geology	384	1	–	1	–
Metallurgy	538	1	–	1	–
Mine Operation and Management	170, 172	2	–	2	6
Mining Geology	405, 406	–	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Petroleum Geology	407, 408	2	–	2	3
Practical Experience	696	–	–	–	–
Precambrian Geology	403, 404	2	2	–	2
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	2	–	–	–
Thesis	738	–	6	–	–

AERONAUTICAL ENGINEERING

(Course 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 130 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 114.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3	–	3	–
Analytical Geometry	503	2	–	2	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	3	4	3	4
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aeronautics	1	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	274	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	2	–	–	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Engineering Problems and Drawing	291	–	3	–	3
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Education	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	3	–	–	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mechanics	27	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	2	3	1	3
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Electrical Engineering	375, 376	2	3	2	3
Heat Engines, Theory	420, 421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	3	2	3
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Propulsion	11	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Gas Dynamics	30	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderantly engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Calculus 491, page 113.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course (see Practical Experience, 698, page 123).

First Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	2	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	$1\frac{1}{2}$
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Dynamics	22	–	–	2	–
Economics	311	2	–	3	–
Electricity	338, 334	2	3	–	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	288	–	6	–	6
Heat Engines, Elementary	420	–	–	2	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	532	2	–	–	–
Physical Education	640	–	2	–	2
Practical Experience	698	–	–	–	–

Third Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	–	2	–
Applied Economics	308	2	–	2	2
Differential Equations	507	1	–	1	–
Electronics	345, 346	2	1½	–	–
Elementary Structural Engineering	29, 298	1	6	1	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	2	1	1	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

Fourth Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Business Policy	309	3	2	3	2
Electric Machines	342, 343	2	3	–	–
Engineering Law	314	1	–	–	–
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Illumination and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy II	547, 548	1	–	1	1½
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	–	2	3
Thesis	740	–	2	–	2

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 33.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, II Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text book: Technical Aerodynamics—K. D. Wood.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Two dimensional airfoil theory; finite wing theory; performance calculation; drag and boundary layers; static stability and control.

Text books: Airfoil and Airscrew Theory—Glauert. Airplane Performance, Stability and Control—Perkins & Hage. Foundations of Aerodynamics—Kuethe & Schetzer.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

Half of the time allotted is spent in the drafting room working problems on airfoil theory, performance, stability, and control. The other half is spent in the wind-tunnel laboratory, where experiments are conducted to illustrate the principles of fluid mechanics, and to demonstrate typical aerodynamic data.

Text book: Wind Tunnel Testing—Pope.

5. Airplane Design and Layout. T. R. Loudon, W. H. Jackson, W. Czerwinski, R. D. Hiscocks, D. G. Allan.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

The preliminary design of light aircraft is discussed in these lectures. It is intended to give the student a grasp of the principles of balance and load distribution necessary for the design of the various components. About three quarters of these lectures are given in a class room, the remainder being given in the laboratory where practical work is carried out.

Text books: Civil Airworthiness Requirements (British). Civil Aeronautics Manual 04 (U.S.).

6. Airplane Design and Layout Laboratory. T. R. Loudon, W. H. Jackson, W. Czerwinski, D. G. Allan.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

This course is divided roughly into three periods devoted respectively to the preliminary design of light aircraft, fitting design and layout and final design of a light aircraft project which is actually constructed under the supervision of skilled aircraft mechanics. The course gives the practical application of the lectures in course 5.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Analysis and Design of Airplane Structures—Bruhn. Aircraft Structures—Peery. Airplane Structures—Niles and Newell.

8. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 3 hrs. laboratory per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. Some of this work is taken in conjunction with light aircraft design in laboratory work described in subject 6.

9. Airplane Stress Analysis. T. R. Loudon, D. G. Allan.

Course 10, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

These lectures serve as an introductory course to the advanced structural analysis course used in aircraft design given in the fourth year. An introductory course is also given on the methods used in determining the balance of an aircraft for the various cases laid down by I.C.A.O. and other governing bodies.

Text books: Analysis and Design of Airplane Structures—Bruhn. Fundamentals of Aircraft Structures—Barton. I.C.A.O.—Airworthiness Manual. A.R.B.—Manual (Section D). C.A.M.—04 (U.S.).

10. Airplane Stress Analysis Laboratory. D. G. Allan.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aircraft Propulsion. R. B. McIntyre.

Course 10, IV Year; 1 hr. lecture per week, both terms.

This course of lectures deals with theory of the propeller. The principles of operation of the reciprocating engine, turbo jet, gas turbine and rocket are explained.

12. Aircraft Layout. W. Jackson, R. D. Hiscocks.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 3, 7, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures.

Text book: Applied Statics—Loudon.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 3, 7, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith, F. C. Hooper, J. M. F. Vickers.

Courses 1 and 7, II Year; 1 hr. lecture per week, both terms.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Reference book: Mechanics—Den Hartog.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins and staff in Civil Engineering.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

For Course 10, the work is carried further in order to cover some more advanced problems dealing with plate girders.

Text book: Resistance of Materials—Seely.

24. Applied Mechanics. T. R. Loudon, B. Etkin, D. G. Allan.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts; statics in the fall term; and dynamics in the spring term.

Statics: Principles of plane statics and application to a variety of problems including elementary framed structures and simple beams.

Dynamics: Principles of dynamics, and application to plane motion of particles, and plane translation of rigid bodies.

Text books: Applied Statics—Loudon. Vectorial Mechanics—Brand.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 2 hrs. lectures per week, first term.

Introduction to vector analysis; vector treatment of kinematics; Coriolis' acceleration; general plane motion of rigid bodies; gyroscopes; dimensional analysis.

Text book: Vectorial Mechanics—Brand.

26. Applied Mechanics. T. R. Loudon, B. Etkin, D. G. Allan.

Courses 2, 6, 8 and 9, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts; statics in the fall term, and dynamics in the spring term.

Statics. Principles of plane statics and application to a variety of problems including elementary framed structures and simple beams.

Dynamics. Principles of dynamics, and application to motion of particles on straight and curved paths—work, energy, power, impulse and momentum. Plane translation of rigid bodies.

Text books: Applied Statics—Loudon. Principles of Physics, Mechanics—Sears.

27. Advanced Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Continuation of course 25, dealing with rotating frames of reference; Euler's Equations for rigid bodies; oscillating systems of one and more degrees of freedom; Lagrange's Equations.

Text books: Vectorial Mechanics—Brand. Principles of Mechanics—Synge & Griffith.

28. Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young and Morrison. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. C. F. Morrison, M. W. Huggins.
Courses 2, 3, and 11, III Year; 1 hr. lecture per week, both terms.
Practically the same work as that for subject 28 in the first term.

30. Gas Dynamics. G. N. Patterson.
Course 10, IV Year; 2 hrs. lectures per week, both terms.
An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods. Some instruction will be given at the Institute of Aerophysics.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.
Courses 1, 2, 5, 9, and 10, II Year; 3 hrs. laboratory per week, second term.
Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.
An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.
Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.
Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.
A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.
Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.
Course 10, III Year; 1 hr. lecture per week, both terms.
Vector operators; classical equations for perfect fluids; velocity potential; stream function; complex potential; Bernoulli's equation for incompressible and compressible flow. Verticity, circulation, lift. Poiseuille flow.
Text book: Fluid Dynamics—Streeter. Airfoil and Airscrew Theory—Glauert.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Courses 1 and 2, III year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool Elementary Structural Engineering—Urquhart and O'Rourke.

Reference Book: Basic Reinforced Concrete Design—Lange.

36. Theory of Structures. C. F. Morrison.

Course 1a, IV Year; 2 hrs. lectures per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

37. Theory of Structures and Reinforced Concrete. Staff in Civil Engineering.

Course 1a, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out in the laboratory following the lecture courses 36 and 41.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1a, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

40. Soil Mechanics and Foundations. T. R. Loudon, W. L. Sagar.

Course 1a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

The design of foundations, retaining walls and dams is discussed in detail preliminary to working out problems in the laboratory.

Reference books: Foundation of Structures—Dunham. Soil Mechanics in Engineering Practice—Terzaghi and Peck. Soil Mechanics, Foundations, and Earth Structures—Tschebotarioff.

Proceedings, Second International Conference on Soil Mechanics. Design of Concrete Structure—Urquhart and O'Rourke.

41. Reinforced Concrete. M. W. Huggins.

Course 1a, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the rigid arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Text book: Basic Reinforced Concrete Design—Large.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

43. Structural Design. M. W. Huggins.

Course 1a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Steel Mill Buildings—Ketchum. Structural Problems—Young and Morrison. Theory of Modern Steel Structures—Grinter.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 3 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Course 3, IV Year; 2 hrs. lectures per week, first term.

Courses 1b and 11, IV Year; 2 hrs. lectures per week, both terms.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson. Structural Problems—Young and Morrison.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1a, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Specifications—Dept. of Highways, Ontario. A.S.T.M.; C.S.A.; A.A.S.H.O. Specifications. Soil Testing for Engineers—Lambe.

APPLIED PHYSICS

70. Applied Physics. F. B. Friend, J. R. Bird, P. A. Macpherson.

Courses 1, 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics—Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. F. B. Friend, J. R. Bird, P. A. Macpherson.

Courses 1, 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

75. Photogrammetry. K. B. Jackson, J. J. Klawe.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

77. Photogrammetry. K. B. Jackson.

Course 1_b, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Photographic optics, photographic materials and processes, photography applied to measurement. Terrestrial and aerial survey photography. Perspective, scale, tip and tilt, rectification. Planimetric mapping. Stereoscopy. Stereoscopic photographs and plotting instruments. Topographic mapping. Photo interpretation. The application of aerial photographs to mapping, to the survey of natural resources, and to planning and development.

78. Photogrammetry. K. B. Jackson.

Course 1_b, IV Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 77.

82. Acoustics. V. L. Henderson.

Course 7, IV Year; 2 hrs. lectures per week, second term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference book: Elements of Acoustical Engineering—Olson.

83. Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Supplementing course 82.

89. Architectural Acoustics. V. L. Henderson.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.
Reference book: Acoustical Designing in Architecture—Knudsen and Harris.

90. Architectural Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 89.

91. Illumination and Acoustics. V. L. Henderson, J. R. Bird.
Course 11, IV Year; 1 hr. lecture per week, both terms.
The production of light and the engineering principles underlying its utilization.
The generation and control of sound.
Reference book: Less Noise Better Hearing—Sabine.

92. Illumination and Acoustics. V. L. Henderson, J. R. Bird, P. A. Macpherson.
Course 11, IV Year; 1½ hrs. laboratory per week, both terms.
A laboratory course supplementing course 91.

93. Illumination. J. R. Bird.
Course 7, IV Year; 2 hrs. lecture per week, second term.
Illuminating Engineering dealing with the nature, measurement, and production of light and related radiations.
Theory of human vision; the design and application of lighting equipment for visual efficiency and comfort. Fundamentals of power supply.

94. Illumination Laboratory. J. R. Bird.
Course 7, IV Year; 3 hrs. per week, second term.
Supplementing subject 93.

95. Photometry and Illumination Design. J. R. Bird.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. J. R. Bird.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference book: Elements of Acoustical Engineering—Olson

98. Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.

Course 5e, IV Year; 1½ hrs. laboratory per week, first term.

Supplementing subject 97.

99. Vibration Engineering. V. L. Henderson.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson, P. A. Macpherson.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ASSAYING, MINING AND ORE DRESSING

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved. but also upon the errors inherent in operators as well as in methods,

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich. The Sampling and Assay of the Precious Metals—E. A. Smith.

161. Assaying Laboratory. M. Hewer.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

The determination of precious metals. Scorification, crucible and combination wet and dry methods of assaying ores both simple and complex; milling and metallurgical products including cyanide solutions, cyanide precipitates and gold bullion. Attention is also given to the sampling and assay of ores containing radio-active minerals.

165. Mining. The Staff in Mining Engineering.
Courses 2 and 9, I Year; 2 hrs. per week, second term.
A combined laboratory and lecture course. It is an introduction to the principles of mining and sampling calculations.

166. Mining. R. E. Barrett.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
A course of lectures relating to underground and surface mining methods, rock boring machinery and practice.

168. Mining. R. E. Barrett.
Courses 2 and 9, III Year; 2 hrs. lectures per week, first term.
Methods of mine development by mine adits, shafts, drifts and crosscuts; stoping methods, loading, and underground transportation.

169. Mining Laboratory. S. E. Wolfe.
Course 2, III Year; 5 hrs. laboratory per week, first term.
Special mining problems are given relating to sampling, diamond drilling, stope measurements, the factors affecting the angle of repose of broken materials and the behaviour of such materials when in motion. To develop the individual students' initiative, some special survey problems are worked in the laboratory.

170. Mine Operation and Management. R. E. Barrett.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, both terms.
Lectures on advanced mining practice, deep mining problems, mine mechanization, underground crushing, hoisting and communications, mine safety and hygiene, mine plant and layout, mining company structure and financing, cost statements, incentive wage plans, and various aspects of labor relations such as labor legislation, unions and collective bargaining.

172. Mining Laboratory. R. E. Barrett.
Courses 2 and 9, IV Year; 2 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Problems in mine layout involving shaft location and size; mine development; choice of stoping methods, mining rate, and mine equipment; time and cost schedules; ore reserve calculations.

175. Mine Ventilation and Allied Problems. G. R. Lord.
Course 2, IV Year; 2 hrs. lectures per week, first term.
Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

176. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.
Course 2, IV Year; 3 hrs. laboratory per week, first term.

Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

180. Mineral Dressing. S. E. Wolfe.

Courses 2, and 8, III Year; 2 hrs. lectures per week, both terms.

The course deals with the economics of, the theoretical principles and their practical application in, the treatment of ores and mineral aggregates. These involve the processes of crushing, grinding, sizing and classification; gravity, magnetic, and electrostatic separation; and an introduction to froth flotation. In addition, ancillary processes are studied. These include flocculation, sedimentation, filtration, drying of mineral products and the precipitation and collection of dust and fume.

182. Mineral Dressing Laboratory. S. E. Wolfe.

Course 2, III Year; Course 8, IV Year; 6 hrs. laboratory per week, second term.

This work is coordinated with the lecture course 180. Studies are made of crushing machinery, the principles of crushing and grading of rock products, screen analysis, and the sampling of broken material and mill products. Certain tests with gravity concentrating machines are made and an introduction to the technique of flotation test work is given.

183 Ore Dressing. S. E. Wolfe.

Course 2 and 8, IV Year; 1 hr. lecture per week, both terms

The subjects covered are extensions of those in 180 and 182; cyanidation, flotation processes and technique, the current practice at milling plants, and problems associated with milling.

184. Ore Dressing Laboratory. S. E. Wolfe.

Course 2, IV Year; 6 continuous hours per week, first term.

Advanced work coordinated with lecture course 183 and pertaining to ore dressing appliances, the handling in bulk of finely divided solids, the selective flotation of sulphides, ore testing, and pilot plant mill runs.

186. Mineral Dressing. S. E. Wolfe.

Course 9, III Year; 2 hrs. lectures per week, first term.

This abridged course deals with current practice and fundamental principles in the field of mineral beneficiation.

190. Theory of Measurements. M. Hewer.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

Engineering work requires the practical utilization of measurements which have varying degrees of precision. This course deals with the philosophy underlying the causes of errors, their effect and relative importance upon computed results, and the interpretation of numbers to represent measurements. The use of charts and

graphs to illustrate certain measurements and the derivation of empirical equations from these charts is also considered.

192. Summer Essay. M. Hewer.

Course 2, III Year:

An essay, or report, written on a mining subject, preferably some phase of work with which the student is associated during summer employment. Subsequently, each student will deliver a talk to his class on the subject chosen. Thus, training is afforded in both technical writing and public speaking. Students are briefed in advance concerning requirements of this course.

193. Problems and Seminar. The Staff in Mining Engineering.

Courses 2 and 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which students are given training in oral expression and in which they discuss technical problems pertinent to the industry. A portion of the time may be given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. H. L. Macklin.

Course 1, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

The derivation of formulae and their application to the solution of spherical triangles and practical problems. Practical determination of time, latitude and azimuth by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Text books: Nautical Almanac for current year and printed lecture notes.

201. Control Surveys and Mapping. O. J. Marshall.

Course 1, III Year; 1 hr. lecture per week, second term.

Principles and Methods of control surveys involving triangulation, traverse, and levelling of various degrees of precision; elementary geodesy and map projections.

Text book: Advanced Surveying and Mapping—Whitmore.

Reference books: Higher Surveying—Breed and Hosmer, Vol. II, 6th Ed. Theory and Practice Surveying—Tracy.

202. Astronomy. O. J. Marshall, W. H. Carr.

Course 1_b, IV Year; 1 hr. lecture per week, first term.

Precise determination of time, latitude, longitude and azimuth as applied to geodetic surveys.

203. Astronomy. W. H. Carr.

Course 1_b, IV Year; 3 hrs. laboratory per week, first term.

Observations and problems to accompany subject 202.

204. Geodesy. O. J. Marshall.

Course 1_b, IV Year; 2 hrs. lectures per week, second term.

Geometry of the spheroid, geographic co-ordinates, common map projections with related co-ordinate systems.

205. Geodesy. O. J. Marshall.

Course 1_b, IV Year; 3 hrs. laboratory per week, second term.

Problems in geodetic computations.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, W. M. Walkinshaw.

Course 1, IV Year; 3 hrs. per week, both terms.

Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration and Contracts. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 299.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, also forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

217. Transportation Engineering.

Course 1a, IV Year; 1 hr. lecture per week, both terms.

Highway: Organization, administration, economics and planning, paving materials, the principles governing location, design and construction of highways and airports.

Reference books: The Highway Improvement Act—Ontario. Highway Standards and Specifications—Department of Highways of Ontario. Highway Design and Construction—Bruce. Highway Engineering—Ritter and Paquette.

218. Town and Regional Planning. A. P. C. Adamson, J. Tyrwhitt.

Course 1_b, IV Year; 2 hrs. lectures per week, first term.

Principles of town planning in relation to residential areas, industrial zones, business and recreation centres, road traffic and parking. General survey of the Ontario Planning Act and its operation.

Text books: Town Planning—Thomas Sharp. Concerning Town Planning — LeCorbusier. City Development — Lewis Mimford. Town Planning & Road Traffic—Alkar Tripp. The Ontario Planning Act.

219. Town and Regional Planning. A. P. C. Adamson, J. Tyrwhitt.

Course 1_b, IV Year; 3 hrs. laboratory per week, first term.

Preparation of an official plan, zoning by-law and site plan for a residential area. Preparation of an outline plan and report on the means by which a long term and short term plan for a wider area can be implemented within the framework on Ontario Legislation.

Text books: The Ontario Planning Act. How to Subdivide—H. Spence Sales. Community Planning Review, Housing Design Supplement No. 1.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. The Staff in Chemical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. W. F. Graydon.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, I Year; 3 hrs. laboratory per week, both terms.

A laboratory course illustrating the fundamental laws of chemistry as dealt with in the lecture course, and providing an introduction to chemical analytical methods.

224. Chemistry. J. G. Breckenridge.

Courses 2 and 9, II Year; 2 hrs. lectures per week, first term.

An introduction to modern theories of molecular structure, and to organic chemistry.

225. Analytical Chemistry. L. J. Rogers.

Course 8, II Year; Course 2, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis; select volumetric and gravimetric methods; technical analysis.

226. Engineering Chemistry. The Staff in Chemical Engineering.

Courses 1, 3, 7, and 11, II Year; 2 hrs. lectures per week, first term.

Water-treatment, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. W. F. Graydon.

Courses 2 and 9, II Year; 3 hrs. laboratory per week, both terms.

Volumetric and gravimetric analysis.

228. Analytical Chemistry Laboratory. L. J. Rogers.

Course 8, II Year; 6 hrs. laboratory per week, second term.

Gravimetric and volumetric methods, acidimetry and alkalimetry.

Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Analytical Chemistry Laboratory. W. F. Graydon

Course 6, II Year.

This course commences on the Wednesday following the first Monday in September, and continues until the opening of the Fall Term. All the working time will be spent on systematic quantitative inorganic analysis.

Text book: Textbook of Inorganic Analysis—Kolthoff and Sandell.

230. Industrial Chemistry. W. G. MacElhinney.

Course 6, II Year; 3 hrs. lectures per week, first term: 3 hrs. laboratory per week, second term.

Manufacture of acids, alkalis, and inorganic chemicals; water-treatment, corrosion, explosives. The second term work consists of calculations dealing with certain industrial chemical problems.

231. Inorganic Chemistry. C. P. Brockett.

Courses 6 and 8, II Year; 2 hrs. lectures per week, first term: 1 hr. lecture per week, second term.

The constitution of matter and classification of the elements: systematic inorganic chemistry.

In preparation for this course, students will be expected to have read and to be familiar with the following: Mellor's Modern Inorganic Chemistry (1951 Edition), Chapters 8, 17–25, 35.

232. Chemical Laboratory. W. G. MacElhinney, W. F. Graydon.

Course 6, II Year; 1 hr. lecture and 9 hrs. laboratory per week, first term; 8 hrs. laboratory per week, second term.

A continuation of subject 229, followed by methods of technical analysis, selected analytical procedures, and instruction in glass-blowing.

233. Industrial Chemistry. P. M. Corbett.

Course 11, II Year; 1 hr. lecture per week, both terms.

Manufacture of acids, alkalis, inorganic chemicals.

234. Organic Chemistry. J. G. Breckenridge.

Course 6, II Year; 3 hrs. lectures per week, second term.

An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

236. Physical Chemistry. R. L. McIntosh.

Courses 6 and 8, II Year; 2 hrs. lectures per week, both terms.

Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

Text book: Principles of Phase Equilibria—Wetmore and LeRoy.

237. Analytical Chemistry Laboratory. L. J. Rogers.

Course 2, III Year; 6 hrs. laboratory per week, second term.

Technical analysis of ores and furnace products; wet assaying.

240. Chemical Theory. R. R. McLaughlin, W. F. Graydon.

Course 6, III Year; 2 hrs. lectures per week, both terms.

A discussion of the principles of adsorption and colloid chemistry; chemical thermodynamics.

241. Industrial Chemistry. W. G. MacElhinney, W. H. Rapson.

Course 6, III Year; 3 hrs. lectures per week, second term.

Chemical process industries, including petroleum, soap, sugar, pulp and paper, and fermentation industries. In preparation for this course, students will be expected to have read and to be thor-

oughly familiar with the following: Chemical Process Industries—Shreve: Chapters 29, 30, 31, 33, 34, 37.

242. Chemical Engineering. W. G. MacElhinney.
Course 6, III Year; 2 hrs. lectures per week, both terms: 3 hrs. laboratory per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other unit operations. The laboratory work in the first term consists of calculations on chemical engineering problems. In preparation for this course, students will be expected to have read and to be thoroughly familiar with recommended chapters from the following text: Unit Operations—Brown.

243. Chemical Engineering Laboratory. W. G. MacElhinney, P. M. Corbett.
Course 6, III Year; 6 hrs. laboratory per week, second term.
Experiments on unit operations to accompany subject 242.

244. Organic Chemistry. J. G. Breckenridge.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234, dealing mainly with aromatic compounds.

245. Organic Chemistry Laboratory. W. H. Rapson.
Course 6, III Year; 6 hrs. laboratory per week, first term; 9 hrs. laboratory per week, second term.
A laboratory course accompanying subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 2 hrs. lectures per week, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Courses 6 and 8, III Year; 18 hrs., first term.
Quantitative measurements to accompany subject 246.

249. Industrial Chemistry Laboratory. W. G. MacElhinney, W. F. Graydon.
Course 6, III Year; 1 hr. lecture and 6 hrs. laboratory per week, first term.
A continuation of subject 232.

250. Organic Chemistry. J. G. Breckenridge.
Course 5, II Year; 2 hrs. lectures per week, first term.
General reactions and methods of synthesis of carbon compounds.
Text book: Organic Chemistry. A Brief Course—Brewster.

251. Chemical Laboratory. W. F. Graydon, A. I. Johnson, P. H. Calderbank.
Course 6, IV Year; 1 hr. lecture and 11 hrs. laboratory per week, first term.
A continuation of subject 243, and includes experiments involving

quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, organic, and analytical chemistry.

253. Chemical Engineering. A. I. Johnson.
Course 6, IV Year; 2 hrs. lectures and 2 hrs. laboratory per week, both terms.
A continuation of subject 242; the laboratory periods consist of calculations on selected chemical engineering problems and instruction in the use of graphical methods.

256. Chemical Engineering Thermodynamics. P. H. Calderbank.
Course 6, IV Year; 2 hrs. lectures per week, both terms.
The application of thermodynamics to problems in the field of chemical engineering.

257. Organic Chemistry. R. R. McLaughlin.
Course 6, IV Year; 1 hr. lecture per week, both terms.
The chemistry of natural and synthetic high-molecular-weight materials.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

269. Descriptive Geometry. A. Wardell.
Courses 1, 2, 6, 8 and 9, I Year; 1 hr. lecture per week, both terms.
These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines and planes.
Text book: Descriptive Geometry—Watts and Rule.

270. Descriptive Geometry. A. Wardell.
Courses 3, 7 and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines, planes and curved surfaces. Problems of shades, shadows and perspective are also dealt with.
Text book: Descriptive Geometry—Watts and Rule.

271. Descriptive Geometry. A. Wardell.
Courses 5 and 10, I Year; 1 hr. lecture per week, both terms.
Course 269 with the addition of some work in curved surfaces.
Text book: Descriptive Geometry—Watts and Rule.

272. Descriptive Geometry. A. Wardell.
Course 1, II Year; 1 hr. lecture per week, both terms.
A continuation of lecture course 269. Problems of curved surfaces,

shades, shadows and perspective are discussed: also, an introduction is given to the principles of projection used in map making.

Text book: Descriptive Geometry—Watts and Rule.

274. Descriptive Geometry. A. Wardell.

Course 10, II Year; 1 hr. lecture per week, both terms.

A continuation of lecture course 271. Problems of curved surfaces, shades, shadows and perspective are discussed with attention to problems of special interest to students in aeronautical engineering.

Text book: Descriptive Geometry—Watts and Rule.

ENGINEERING PROBLEMS AND DRAWING

The courses in Engineering Problems and Drawing consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems in the First and Second Years deal with the fundamental engineering studies—mathematics, applied mechanics, descriptive geometry, the plotting of surveys that have been made by the student in the field, theory of machines, while in the Third and Fourth Years, the problems deal mainly with design.

275. Engineering Problems and Drawing. A. Wardell.

Courses 2 and 9, I year; 6 hrs. per week, first term; 7 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus.) Plotting or original surveys.

Text book: Engineering Drawing—French-Vierk, 8th Edition.

279. Engineering Problems and Drawing. A. Wardell.

Course 5, I Year; 3 hrs. per week, both terms.

Course 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Plotting of original surveys.

Text book: Engineering Drawing—French-Vierk, 8th Edition.

280. Engineering Problems and Drawing. A. Wardell.

Course 6, I Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Course 8, I Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. The solving of problems in descriptive geometry, applied mechanics, and mathematics.

Text book: Engineering Drawing—French-Vierk, 8th Edition.

284. Engineering Problems and Drawing. A. Wardell.

Course 1, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials. Problems in mathematics (calculus).

Textbook: Engineer!ng Drawing—French, 7th Edition.

285. Engineering Problems and Drawing. A. Wardell.

Course 2, II Year; 6 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheets. Plotting of original surveys.

Textbook: Engineering Drawing—French, 7th Edition.

286. Engineering Problems and Drawing. A. Wardell.

Course 3, II Year; 6 hrs. per week, both terms.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of machines. Problems in mathematics (calculus).

Textbook: Engineering Drawing—French, 7th Edition.

287. Engineering Problems and Drawing. A. Wardell.

Course 6, II Year; 3 hrs. per week, alternate weeks, both terms.

Problems in mathematics.

Textbook; Engineering Drawing—French, 7th Edition.

288. Engineering Problems and Drawing. A. Wardell.

Course 7, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Course 11, II Year; 6 hrs. per week both terms.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials. Problems in mathematics (calculus).

Textbook: Engineering Drawing—French, 6th Edition.

289. Engineering Problems and Drawing. A. Wardell.

Course 8, II Year; 3 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials and mathematics.

Textbook: Engineering Drawing—French, 7th Edition.

290. Engineering Problems and Drawing. A. Wardell.

Course 9, II Year; 3 hrs. per week, both terms.

Problems in descriptive geometry and mechanics of materials.

Textbook: Engineering Drawing—French, 7th Edition.

291. Engineering Problems and Drawing. A. Wardell.

Course 10, II Year; 3 hrs. per week, both terms.

Problems in descriptive geometry— intersection of curved surfaces. Problems in mechanics of materials.

Textbook: Engineering Drawing—French, 7th Edition.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 1, III Year; 9 hrs. per week, both terms.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses.

298. Engineering Problems and Drawing. W. B. Dunbar.
Course 2, III Year; 3 hrs. per week, second term.
Course 3, III Year; 3 hrs. per week, both terms.
Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week, second term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar.
Course 1a, IV Year; 3 hrs. per week, both terms.
Problems based on lecture course 43.

300. Structural Design Drawing. W. B. Dunbar.
Course 3, IV Year; 3 hrs. per week, first term.
Courses 1_b and 11, IV Year; 3 hrs. per week, second term.
Problems in determination of stresses in, and design of mill building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. F. N. Beard.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.
Basic accounting principles and procedures, the preparation and interpretation of financial statements, cost accounting, and the use of accounting as a means of control.

307. Statistics. D. C. MacGregor.
Course 11, III Year; 2 hrs. lectures per week, both terms.
An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. S. Stykolt.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.
A survey of contemporary economic institutions and problems and the application of economic theory to income determination, money and banking, industrial fluctuations, fiscal policy and labour problems.

309. Business Policy. A. W. Currie, G. F. Bain.
Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.
Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.

Courses 1, 2, 3, 7, and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. S. Triantis.

All courses, II Year; 2 hrs. lectures per week, both terms.

An Introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An introduction to Political Economy—Bladen.

313. Engineering Economics.

Courses 1, 2, 7, 8 and 9, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. W. O. Chris. Miller.

Courses 1, 3, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, construction contracts, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management. R. E. Barrett.

Course 8, IV Year, 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of management, including labour relations, plant organizing, maintenance and safety.

318. Industrial Management. E. A. Allcut.
Courses 1, 3, 6 and 7, IV Year; 1 hr. lecture per week, both terms.
A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.
Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.
Course 6, III Year; Course 6, IV Year; 1 hr. per week, both terms.

321. Industrial Management A. E. A. Allcut, K. C. Livingston.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, first term; 1 hr. lecture and 1 hr. laboratory per week, second term.
An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.
Text book: Principles of Industrial Management—Allcut.

323. Introduction to Political Science. M. P. O'Connell.
All courses, III Year; 2 hrs. lectures per week, second term.
An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. H. I. Nelson.
All courses, III Year; 2 hrs. lectures per week, first term.
An outline of the chief trends and developments in selected key areas during the 19th and 20th centuries.

325. Modern Political and Economic Trends. C. F. Owen.
All courses, IV Year; 18 lectures, second term.
A study of the theory and practice of modern economic and political trends.

326. Philosophy of Science. Marcus Long.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, IV Year; 2 hrs. lectures per week, first term.
The relation between Science and Philosophy; an examination of the presuppositions of science and its basic concepts; alternative accounts of the nature of the universe with their implications for social and moral behaviour.

327. The Profession of Engineering. G. R. Lord.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, IV Year; 6 lectures, second term.
Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering.

328. Industrial Management B. T. C. Graham, J. C. Sawatzky.
Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service, etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. Staff in Electrical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference book: Introduction to Electrical Engineering—Ward.

332. Electricity. H. A. Courtice, G. F. Tracy.

Course 7, II Year; 2 hrs. lectures per week, both terms.

General principles and calculations of electric circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacitance, power, and energy. In the second term, a study of alternating-current circuits is commenced, including characteristics of sinusoidal waves, series circuits, complex algebra, parallel circuits, power and power factor, all with reference to the single-phase circuit.

Reference books: Basic Electrical Measurements—Stout. Alternating-Current Circuits—Kerchner and Corcoran. Alternating-Current Circuits—Tang.

333. Electrical Fundamentals. J. E. Reid.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

Reference book: Electric and Magnetic Fields—Boast.

334. Electrical Laboratory.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

335. Electrical Problems.

Course 7, III Year; 2 hrs. per week, first term; 4 hrs. per week, second term.

Problems associated with subjects 336, 337, 339, 341 are assigned and worked out under staff supervision. As practice in public speaking, one hour per week in the second term is used for short talks by students on subjects of their own choosing. Comments and suggestions are made by staff members in charge.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, both terms.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair.

Course 7, III Year; 2 hrs. lectures per week, both terms; 3 hrs. laboratory per week, alternate weeks, second term.

The behaviour of electrons in electric and magnetic fields and the application of electronics to electrical engineering.

Reference book: Electromic Engineering Principles—Ryder.

338. Electricity. H. A. Courtice.

Courses 3 and 11, II Year; 2 hrs. lectures per week, first term.

General principles and calculations of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Basic Electrical Measurements—Stout.

339. Direct Current Machines. C. E. Doeringer.

Course 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering. Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of

Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

341. Alternating Currents. J. E. Reid.

Course 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Machines. C. E. Doeringer.

Course 11, IV Year; 2 hrs. lectures per week, first term.

Operating characteristics and applications of direct-current and alternating-current machines.

343. Electric Machines Laboratory.

Course 11, IV Year; 3 hrs. laboratory per week, first term.

Laboratory exercises to accompany Subject 342.

344. Electrical Laboratory.

Course 7, III Year; 3 hrs. laboratory per week, both terms.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Electronics. G. F. Tracy and Staff.

Courses 3 and 11, III Year; 2 hrs. lectures per week, first term.

Thermionic emission, vacuum-tube characteristics and applications, amplifiers, gaseous-tube characteristics and applications.

Text book: Basic Electrical Engineering—Fitzgerald.

346. Electronics Laboratory.

Courses 3 and 11, III Year; 3 hrs. laboratory alternate weeks, first term.

Laboratory exercise to accompany subject 345.

347. Electric Circuits and Machines. G. F. Tracy and Staff.

Courses 1, 2 and 9, II Year; 1 hr. lecture per week, both terms.

Principles of alternating-current circuits, impedances in series and parallel, three-phase circuits. Power measurement in single-phase and polyphase circuits. The transformer and the induction motor.

348. Electrical Laboratory.

Courses 1, 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Introductory laboratory practice in methods of measuring electrical quantities. Experiments on alternating-current circuits, the transformer and the polyphase induction motor.

351. Circuit Analysis. V. G. Smith.

Course 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.

Course 5e, IV Year; 2 hrs. lectures per week, both terms.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid, G. Sinclair, L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, both terms.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are anlyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. G. F. Tracy.

Course 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Electric Circuits. L. S. Lauchland.

Course 5, II Year; 2 hrs. lectures per week, both terms.

Principles of direct-current circuits including the more important methods of measuring resistance, potential difference, current, power and energy. Principles of alternating-current circuits together with methods of calculating single-phase and polyphase circuits, network theorems.

355. Electrical Laboratory.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week, second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electric Circuits Laboratory.

Course 5, II Year, 3 hrs. laboratory alternate weeks, both terms.

Laboratory exercises to accompany subject 354.

357. Engineering Electronics. J. M. Ham.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, first term 1 hr. lectures per week, second term.

Electronic devices, such as the thyratron, ignition and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.

Course 7, IV Year; 2 hrs. per week, both terms.

Oral presentation by each fourth year student of his thesis, together with discussions by other members of the group.

360. Communications I. J. E. Reid, G. Sinclair.

Courses 5e, 5i, 5s, 5m and 7, IV Year; 3 hrs. laboratory per week, first term.

The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.

Reference book: Electron-Tube Circuits—Seely.

361. Communications Laboratory.

Courses 5e, 5i, 5s, 5m and 7, IV Year; 2 hrs. lectures per week, both first term.

Experiments and problems to accompany subject 360.

362 Communications II. J. E. Reid, G. Sinclair.

Courses 5e and 7, IV Year; 3 hrs. lectures per week, second term.

A continuation of subject 360.

363. Communications Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory per week, second term.

Experiments and problems to accompany subject 362.

364. Operational Methods. V. G. Smith.

Courses 5e, 5i, 5m, and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Cicuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus —Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5e, 5g, 5m and 5s, IV Year; 2 hrs. lectures per week, both terms.

A comparison of the classical, the rationalized C.G.S. and the M.K.S. systems of units is made, thereafter the M.K.S. rationalized system is used exclusively. Electrostatics is developed to the point where it is used to compute the capacities of engineering structures. Magnetostatics is mentioned briefly. The laws of electromagnetism are reviewed and Maxwell's equations developed. These are applied in a study of the reflection and refraction of plane waves, in an elementary study of rectangular wave guides and of the radiation from an antenna.

Reference books: Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague. Fundamentals of Electric Waves—Skilling. Wave Guides—Lamont.

366. Electronics. V. G. Smith.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Basic theory of the behaviour of electrons in electric and magnetic fields, thermionic emission, vacuum-tube characteristics and applications, conduction through gases, gaseous-tube characteristics and applications.

Reference books: Applied Electronics—M.I.T. Staff.

367. Alternating-Current Circuits. G. F. Tracy and Staff.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Methods of treating alternating-current circuits, root-mean-square values, series circuits containing resistance, inductance and capacitance, parallel circuits, three-phase circuits.

368. Alternating-Current Circuit Laboratory.
Courses 3 and 11, II Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises to accompany subject 367.

369. Alternating Current Machinery II. G. F. Tracy.
Course 7, IV Year; 2 hrs. lectures per week, second term.
A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.
Courses 5e and 7, IV Year; 2 hrs. lectures per week, second term.
Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory.
Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises and problems to accompany subject 371.

373. Electric Power Systems. L. S. Lauchland.
Course 7, IV Year; 2 hrs. lectures and 2 hrs. computation per week, second term.
General considerations of generation, transmission, and distribution; steady-state performance of systems, metering, fault calculations, fusing, relaying, lightning phenomena.

375. Electrical Engineering. A. J. Kravetz.
Course 6, II Year; 2 hrs. lectures per week, both terms.
Courses 8 and 10, III Year; 2 hrs. lectures per week, both terms.
Principles of d-c and a-c circuits including the more important methods of measuring resistance, current, potential difference, power and energy; the principles of operation of d-c and a-c machinery; thermionic tube characteristics and applications.

376. Electrical Engineering Laboratory.
Course 6, II Year; 3 hrs. laboratory per week, both terms.
Courses 8 and 10, III Year; 3 hrs. laboratory per week, both terms.
Laboratory exercises to accompany subject 375.

377. Electric Machines. G. F. Tracy.
Courses 3 and 5e, III Year; Course 5t, IV Year; 2 hrs. lectures per week, both terms.
Operating characteristics, control, and applications of direct-current and alternating-current machines.

378. Electric Machines Laboratory.
Course 3, III Year; 3 hrs. laboratory alternate weeks, first term: 3 hrs. laboratory per week, second term.
Course 5e, III Year; Course 5t, IV Year; 3 hrs. laboratory per week, both terms.
Laboratory exercises to accompany subject 377.

379. Electronics Laboratory.
Course 5, III Year; 3 hrs. laboratory per week, second term.
Laboratory exercises to accompany subject 366.

GEOLOGICAL SCIENCES

380. Physical Geology. P. A. Peach.
Courses 2 and 9, I Year; 2 hrs. lecture per week, both terms.
An introduction to the study of geology and mineralogy.
Reference Books: Principles of Physical Geology—Holmes. Outlines of Historical Geology—Schuchert and Dunbar.

381. Physical Geology Laboratory. C. V. Phipps.
Courses 2 and 9, I Year; 2 hrs. per week, second term.
A laboratory course to accompany subject 380. Local field trips.

382. Engineering Geology. A. MacLean.
Courses 1 and 5g, III Year; 2 hr. lecture per week, both terms.
Structural, dynamic and economic geology, with special reference to engineering problems.

383. Engineering Geology Laboratory. C. V. Phipps.
Courses 1 and 5g, III Year; 1 hr. per week, first term; 2 hrs. per week, second term.
Specimens, maps, and sections to accompany subject 382.

384. Glacial Geology. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.

385. Elementary Geochemistry. F. G. Smith.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Covering the periodic table, distribution of the elements, states of matter, phase diagrams, natural hydrothermal solutions, weathering, and geochemical cycles.

386. Mineralogy and Lithology. D. H. Gorman, P. A. Peach.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. lecture per week, both terms.
A study of crystallography, descriptive and determinative mineralogy, and the common rocks.
Reference book: An Introduction to the Study of Minerals—Rogers.

387. Mineralogy and Lithology Laboratory. D. H. Gorman, P. A. Peach.
Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. per week, both terms.
Practice in identifying minerals and rocks.

388. Descriptive Mineralogy. D. H. Gorman.
Course 9, IV Year; 2 hrs laboratory per week, both terms.
Continuation of the mineralogy of subject 386.

390. Morphological Crystallography. E. W. Nuffield.
Courses 5m and 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

391. Petrology. P. A. Peach.
Course 9, III Year; 3 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.
Microscopic character of the rock-forming minerals in thin sections, and description and classification of rocks.
Text book: Optical Mineralogy—Rogers and Kerr.

392. Petrography Laboratory. P. A. Peach.
Course 9, III Year; 2 hrs. per week, both terms.
Microscopic petrography, to accompany subject 391.
Text books: As in subject 391.

393. Historical and Stratigraphical Geology. F. W. Beales.
Course 9, II Year; 2 hrs. lectures per week, both terms.
Study of the principles of stratigraphy and historical geology since Precambrian times.

394. Historical and Stratigraphical Geology Laboratory. F. W. Beales.
Course 9, II Year; 2 hrs. per week, both terms.
Laboratory work to illustrate subject 393.

395. Palaeontology. M. A. Fritz.
Course 9, III Year; 2 hrs. lectures per week, both terms.

396. Palaeontology Laboratory. M. A. Fritz.
Course 9, III Year; 2 hrs. per week, both terms.

397. Structural Geology. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Structures caused by the deformation of the earth's crust.
Text book: Structural Geology—Billings.

398. Structural Geology Laboratory. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 3 hrs. per week, both terms.
Work with geological maps of folded and faulted areas, structural sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 397.

399. Mineral Deposits. W. H. Gross.
Courses 2 and 9, III Year; Courses 5g and 8a, IV Year; 2 hrs. lectures per week, both terms.
The first term covers the metallic ore deposits and the second term the non-metallic deposits, including coal and petroleum.

400. Mineral Deposits Laboratory. W. H. Gross.
Course 9, III Year; 3 hrs. per week, both terms.

401. Geology of Canada. F. W. Beales.
Course 9, IV Year; 1 hr. lecture per week, both terms.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

403. Precambrian Geology. W. W. Moorhouse.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Precambrian formations of Canada—their rocks, distribution, relationships and economic features.

404. Precambrian Geology Laboratory. W. W. Moorhouse.
Course 9, IV Year; 2 hrs. laboratory per week, both terms.
To accompany subject 403.

405. Mining Geology. G. B. Langford.
Courses 2, 5g and 9, IV Year; 2 hrs. lectures per week, second term.
A course dealing with the application of geology to mining.
Reference book: Mining Geology—McKinstry.

406. Mining Geology Laboratory. G. B. Langford.
Course 9, IV Year; 3 hrs. per week, both terms.
A laboratory course to accompany subject 405.

407. Petroleum Geology. W. M. Tovell.
Course 9, IV Year; 2 hrs. lectures per week, both terms.
The origin, nature, and occurrence of petroleum and natural gas deposits and the extraction of these substances from the earth.

408. Petroleum Geology Laboratory. W. M. Tovell.
Course 9, IV Year; 3 hrs. per week, second term.
Accompanying subject 407.

409. Geological Field Work.
Courses 2 and 9, III Year; given at the University Survey Camp preceding the opening of the first term. Students taking this course must supply themselves with a geological pick, hand lens, and engineer's 6″ pocket scale.
Reference book: Field Geology—Lahee.

410. Geological Field Trips (Historical Geology).
Course 9, II Year (1 day).
The Niagara Escarpment and the west end of Lake Ontario.

411. Geological Field Trips (Precambrian and Mineralogy).
Course 9, III Year. 2½ days.
Bancroft and Madoc Areas.

412. Geological Field Trips (Glacial Geology).
Courses 2 and 9, IV Year. Three ½ day trips.
During October weekly trips will be made to points of interest near Toronto.

413. Geological Field Trips (Petroleum).
Course 9, IV Year. 2½ days.
Oil and gas fields in Chatham area.

414. Geological Field Trips (Economic and Mining).
Course 9, IV Year. Two trips, each ½ day.
Trip to gypsum mine and cement plant.

HEAT ENGINES

420. Elementary Heat Engines. F. G. Ewens, P. B. Hughes.
Course 3, II Year; 2 hrs. lectures per week, second term.
Course 11, II Year; 2 hrs. lectures per week, second term.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
Course 7, II Year; 1 hr. lecture per week, first term.
Course 10, III Year; a reading course.
The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.
Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut, F. C. Hooper.
Course 3, III Year; 2 hrs. lectures per week, both terms.
Courses 7 and 10, III Year; 2 hrs. lectures per week, both terms.
Course 11, III Year, 2 hrs. lectures per week, both terms.
For each group selected topics are arranged to suit the courses included in the group.
The application of the laws of thermodynamics to ideal processes and cycles using gases and vapours. The cycles used in practice for steam and internal combustion engines, compressors and refrigerating plants. Unavailable energy and entropy. Theoretical and practical efficiencies obtainable. Heat transfer and regeneration. Tables and charts for vapours used in engineering practice.
Reference book: Elementary Engineering Thermodynamics—Young and Young.

422. Heat Engineering. R. C. Wiren, W. A. Wallace, F. C. Hooper.
Courses 3 and 5t, III Year; 2 hrs. lectures per week, both terms.
Steam Turbines. Types and basic characteristics; condensers and auxiliaries.

Text book: Steam Power Plants—Potter.

Steam Generators and Plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design of boilers, furnaces, stokers, pulverised fuel equipment, economizers, air heaters, superheaters, etc.

Text book: Steam Power Plants—Potter.

Internal Combustion Engines. Types and operation; performance and testing; basic characteristics and principles of design; carburation; fuel injection; governing.

Text book: Internal Combustion Engines—Obert.

Heat Transfer and Air Conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Reference books: Internal Combustion Engines—Polson. Maleev. Fraas. Steam Turbines—Church. Steam Power Plants—Gaffert. MacNaughton. Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Courses 3, 5t, and 10, III Year; 1 three-hour laboratory period per week, both terms.

Course 7, III Year; 1 three-hour laboratory period per week, first term.

Courses 6 and 11, III Year; 1 three-hour laboratory period per week, second term.

The laboratory work is designed to assist in clearer understanding of theory and practical applications, and consists of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

The work on Heat Engines deals with the setting of slide valves, measuring indicated and brake horse-power, the use of power plant instruments and auxiliaries, testing of air compressors, steam engines, steam turbines and internal combustion engines under various conditions, steam calorimetry and the solution of numerous practical problems on steam plants, internal combustion engines, and gas turbines.

The Fuel Testing includes analysis of fuels and products of combustion, knock rating of gasolines, fuel calorimetry, etc.

The work on Heat Transfer deals with temperature measurement, tests on insulation and heat exchangers of various kinds.

The work on air conditioning deals with the use of instruments and charts, air conditioning standards, the solution of practical problems, and testing of air conditioning equipment.

424. Heat Power Engineering. R. C. Wiren.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

A continuation of lecture course 421 consisting of a more advanced study as applied to power plants. Properties of pure substances. Analysis and applications of the First and Second Laws. Change of phase and equations of state. Thermodynamic functions and relations as applied to a perfect gas and working fluids used in power plants. Steam as a working fluid. Steam turbines. Power plant cycles including reciprocating engines and turbines. Cycles for high pressures and temperatures. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies. Design of power plant equipment.

Reference books: Heat and Thermodynamics—Zemansky. Engineering Thermodynamics—Obert. Young. Sears. Everett. Keenan. Ebaugh. Hawkins. Steam Power Plants—Gaffert. Potter. MacNaughton. Steam Turbines—Church. Salisbury.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3 and 5t, IV Year; 1 hr. lecture per week, both terms.

The various types of internal combustion engine and their respective applications. The different cycles of operation and the avoidable and unavoidable losses. The admission, compression, combustion, expansion and exhaust operations, the factors that influence them and their application to the engine and turbine. The cooling system and its effect on thermal and mechanical conditions.

426. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Course 3, IV Year; 5 hrs. laboratory work per week, both terms.

Course 5t, IV Year; 6 hrs. laboratory work per week, both terms.

A continuation and extension of the work covered in the III Year laboratory subjects consisting of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

In the Heat Engine laboratory complete tests are made of various engines such as simple, compound and uniflow steam engines, impulse and reaction type steam turbines, steam injectors, gas, oil and gasoline engines. In each case an analysis is made of the thermal cycle involved, a complete set of experiments is performed and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. An analysis is made of cycles used in gas turbines and jets. Problems involving variable specific heat are studied.

In the Fuel Testing laboratory the octane rating of gasoline samples is determined by A.S.T.M. methods and fuel injection spray characteristics are studied with special test equipment.

In the Heat Transfer laboratory tests are made on heat exchangers.

In the Air Conditioning and Refrigeration laboratory tests are performed on complete air conditioning systems, and complete refrigerating plants.

427. Theory of Heat Engines. R. C. Wiren.

Course 1, III Year; Course 2, IV Year; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to engines, nozzles, turbines, compressors, heat transfer devices, refrigeration plants, and air conditioning systems. Analysis of vapour and gas power cycles.

Text book: Basic Thermodynamics—Brown.

Reference books: Engineering Thermodynamics—Young, Ebaugh. Theory and Practice of Heat Engines—Faires.

428. Heat Engine Laboratory. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Course 1, III Year; 2 hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

430. Heat Power Engineering. R. C. Wiren.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Application of Thermodynamics to the design of power plant equipment. Analysis of high pressure and high temperature vapour cycles. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies.

Reference books: Steam Power Plants—Gaffert. Potter. MacNaughton. Steam Turbines—Church, Salisbury. Engineering Thermodynamics—Obert, Young, Keenan, Hawkins.

431. Theory of Heat Engines. P. B. Hughes.

Course 6, III Year; 2 hrs. lectures per week, first term.

The theory and practice of heat engines, including a study of fundamental principles involved, an appraisal of theoretical developments, and a survey of the corresponding practical applications.

Text book: Theory and Practice of Heat Engines—Faires.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2 III Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes and open channels, with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, D. G. Huber, M. J. Kenn.

Courses 1, 3 and 11, III Year; one 3-hr. laboratory period per week, second term.

Course 2, III Year; six 3-hr. laboratory periods, first term.

Course 7, III Year; one 3-hr. laboratory per week; first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. The lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc. are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3- and 2-hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomena, fans and ductwork, and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps. Turbines and water power developments.

446. Hydraulic Laboratory. G. R. Lord, D. G. Huber.

Course 1, IV Year; one 3-hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. L. E. Jones.

Courses 7 and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure density-height relationships. Measurement of pressure intensity. Fluid thrust on submerged surfaces. Buoyancy and flotation.

448. Mechanical and Thermal Measurements. L. E. Jones.

Courses 2, 3, 7, 9, and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities and means of measuring them. Dimensions, units, standards. Length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 3 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analyzing technical data; elements of curve-fitting and statistical treatment.

In order to prepare the student for subsequent laboratory and design work, the material of this course will be based on elements of fluid mechanics and hydraulics.

450. Hydraulics. D. G. Huber.

Course 5t, III Year; 1 hr. lecture per week, both terms.

A course emphasizing the fundamentals of fluid flow in pipes with special reference to refrigeration problems and including discussion of pumps.

Reference books: Elementary Fluid Mechanics—Vennard. Centrifugal Pumps and Blowers—Church. Refrigerating Data Book.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Fluid Mechanics. L. E. Jones.

Course 6, IV Year; 2 hrs. lectures per week, first term.

The fundamentals of fluid flow as generally encountered in industry. Fluid properties, fluid statics, energy relations, dimensional analysis and dynamic similarity, flow in pipes and channels, resistance of submerged bodies, effects of viscosity and compressibility, lubrication, pumps and other hydraulic machines.

Text book: Fluid Mechanics—Binder.

453. Fluid Mechanics Laboratory. G. R. Lord, L. E. Jones.

Course 6, IV Year; 3 hrs. laboratory per week, first term.

A course of laboratory experiments and design problems to permit of correlating flow fundamentals with industrial applications.

MACHINERY

461. Mechanical Engineering. W. G. McIntosh.

Course 3, II Year; 2 hrs. lectures per week, both terms.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

462. Elementary Machine Design. R. T. Waines.

Course 7, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machin-

ing, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Manufacturing Equipment and Processes—Lytle and Gould.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design (involving material applications and calculation of stresses) and selection of various machine elements with particular application to power transmission (belting, shafting and gearing), fastening screws, power screws and wire rope.

Text book: Design of Machine Members—Vallance and Doughtie.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory will illustrate the lecture subject.

465. Theory of Machines. I. W. Smith.

Course 3, II Year; 3 hrs. lectures per week, both terms.

Course 10, II Year; 3 hrs. lectures per week, first term.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical application. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams, including inertia effects. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating and reciprocating parts.

Text book: Mechanism—Prageman.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Members—Vallance & Doughtie.

468. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines, O. O. Cochkanoff.

Course 3, III Year; 6 hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.
Course 10, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, both terms.

Design laboratory work will be taken by students in all courses listed above. This will involve the design of machine elements with the object of illustrating the work covered in the lecture subjects in Machine Design. Sketching and drafting will be given with a view to developing the student's judgment and sense of proportion in design and the application of drafting room standards.

Mechanics of Machinery laboratory work will be taken by Course 3 only. This will include the analytical and graphical solution of problems dealing with inertia loads and stresses and the determination of speed fluctuation.

Mechanical laboratory work will be taken by Courses 3 and 10. This will include selected experiments in speed measurement, oil testing, balancing, vibrations, testing of power drives, etc.

Machine and Welding Shops laboratory work will be taken by all groups. This will take the form of demonstrations of equipment in these shops with a view to assisting students in the visualization of manufacturing methods employed for parts being designed.

469. Machine Design. R. T. Waines.

Courses 2 and 8, IV Year; 1 hr. lecture per week, both terms.

The design and selection of machinery and equipment met with in metallurgical plants, and in mining work.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6 and 8, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. O. O. Cochkanoff.

Course 5, III Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Members—Vallance & Doughtie.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, O. O. Cochkanoff.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

This is a continuation of Subjects 467 and 466. It will involve the design of various machine elements and equipment including machine frames, hooks, hoisting equipment, crankshafts, gears (helical, herringbone, bevel, screw, and worm), springs, clutches, brakes, thin and thick wall vessels.

An introduction will be given to the study of vibration problems encountered in high speed engines and machines.

Text book: Design of Machine Members—Vallance and Doughtie.

474. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Advanced laboratory work involves both analysis and design of machine elements, machine units, and complete machines. The selection of problems is made with a view to giving the student as broad a coverage as possible and providing experience in combining of elements to form a machine of smooth and harmonious design. Some of this work will involve special shafting problems including graphical solutions, critical speeds, and multiple supports.

Work will be given in the Mechanical Laboratory on gauging and fine measurements, experimental stress analysis, vibration, and bearing testing.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Members—Vallance & Doughtie.

476. Manufacturing Processes. K. C. Livingston.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

First term work deals with the steel industry. Processes considered are those involved in iron and steel production, casting, machining, welding and heat treatment.

Processes by which textiles, glass, paper and rubber are manufactured are discussed during the second term.

Text book: Manufacturing Processes—Begeman.

477. Manufacturing Processes Laboratory. K. C. Livingston.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Problems based upon the topic treated in subject No. 476 will be given during the first term.

The class during the second term will be concerned with the process and management problems of some industries.

478. Machine Design. I. W. Smith.
Course 5t, IV Year; 1 hr. lecture per week, both terms.
A series of lectures intended to supplement subject 471 of the Third Year, while co-ordinating with the Fourth Year thermodynamic subjects, by presenting the overall approach employed in the design of simple power units.

479. Machine Design. R. T. Waines.
Course 6, IV Year; 2 hrs. lectures per week, both terms.
The design of various machine elements, particularly those likely to be met with in chemical plants, and an outline of the properties, production methods, and selection of materials used in machine equipment.
Text book: Introduction to Mechanical Design—Jefferson and Brooking.

480. Mechanical Engineering Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, O. O. Cochkanoff.
Course 3, II Year; 3 hrs. laboratory per week, both terms.
Problems will be given in mechanical engineering, including velocity, acceleration, and force analyses; speed fluctuation; cam layout; gearing; and balancing.

MATHEMATICS

490. Calculus. I. R. Pounder, G. A. Dirac, G. F. D. Duff, J. A. Jacobs, B. Lapidus, W. T. Tutte, A. W. Walker.
Courses 1, 2, 3, 6, 7, 8, 9, and 11, I Year; 2 hrs. lectures per week, both terms.
Derivation of the fundamental formulas of the differential and integral calculus, with applications to problems concerning curves, areas, volumes, lengths. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

491. Calculus. J. D. Burk, G. Lorentz, E. E. Noonan, G. de B. Robinson.
Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.
Continuation of subject 490. The elementary theory reviewed and extended, with special attention to applications in engineering. Introduction to simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288 and 289.

492. Analytical Geometry. I. R. Pounder, G. A. Dirac, G. F. D. Duff, J. A. Jacobs, W. T. Tutte, A. W. Walker.
Courses 1, 2, 3, 6, 7, 8, 9, and 11, I Year; 1 hr. lecture per week first term: 2 hrs. lectures per week second term.
The Analytical Geometry covers the more familiar propositions dealing with the straight line, circle, parabola, ellipse, and hyper-

bola. Introduction to Analytical Geometry of Three Dimensions. In addition, problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282 and 283.

494. Least Squares. O. J. Marshall, H. L. Macklin.

Course 1, II Year; 3 hrs. laboratory per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulæ.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes.

495. Mathematical Problems. W. J. Webber, D. A. F. Robinson, W. T. Tutte, K. Okashimo, S. Schuster.

Courses 5 and 10, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. W. J. R. Crosby.

Courses 5 and 10, I Year; 3 hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books: Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. R. G. Stanton.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and conics, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special

functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. W. T. Tutte.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. D. A. S. Fraser, Miss C. C. Krieger, G. Lorentz, A. Robinson.

Courses 1, 3, 6, 8, and 11, III Year; 1 hr. lecture per week, both terms.

First order equations solvable by quadratures, linear equations of first and second orders, linear equations with constant coefficients of higher order.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorf, and Pohlhausen. Introduction to Complex Variables and Applications—Churchill.

509. Differential Equations. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. J. A. Steketee.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. Robinson, J. A. Steketee.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

Text books: Fourier series and Boundary Value Problems—Churchill. Modern Operational Mathematics in Engineering—Churchill. Partial Differential Equations of Mathematical Physics—Webster.

523. Adjustment of Observations. O. J. Marshall.

Courses 1_b, IV Year; 3 hrs. per week, second term.

Problems illustrating the application of Least Squares to the adjustment of observed data, with particular reference to surveying measurements.

METALLURGY

530. Metallurgy. L. M. Pidgeon, B. Chalmers.

Course 8, II Year; 1 hr. lecture per week, both terms.

Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations, and principles of physical metallurgy.

531. Metallurgical Problems Laboratory. H. U. Ross.

Course 8, III Year; 2 hrs. laboratory per week, both terms.

Problems in physical chemistry and thermodynamics as applied to metallurgical reactions.

532. Physical Metallurgy I. B. Chalmers, W. C. Winegard.

Course 11, II Year; Course 3, III Year; 2 hrs. lectures per week, first term.

A general course in Physical Metallurgy, dealing with the structure of metals and alloys, with special reference to the ferrous and non-ferrous alloys of practical importance. The influence of mechanical deformation, heat treatment and composition on the structure is considered, and the relation between the structure and the mechanical properties is examined.

533. Metallurgical Theory. H. U. Ross.
Course 8, III Year; 2 hrs. lectures per week, both terms.
The physico-chemical principles of metallurgy.

534. Principles of Extractive Metallurgy. L. M. Pidgeon.
Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A general discussion of the fundamental principles of extractive metallurgy with reference to the production of the more important metals.

535. Principles of Extractive Metallurgy Laboratory. H. U. Ross.
Course 8, III Year; 3 hrs. laboratory per week, first term.
Experiments in pyrometry, roasting, smelting, leaching, retorting and refining designed to illustrate the principles underlying these operations. Spectrographic analysis of metals is included.

536. Principles of Physical Metallurgy. B. Chalmers.
Courses 5m and 8, III Year; 2 hrs. lectures per week, both terms.
One hour lecture per week in first term consists of a series of lectures on the structure of solids, with particular reference to x-ray methods of investigation.

537. Physical Metallurgy Laboratory. B. Chalmers, W. C. Winegard.
Courses 5m and 8, III Year; 3 hrs. laboratory per week, both terms.
Practical work relating to subject 536.

538. Metallurgy. L. M. Pidgeon.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes.

539. Metallurgy Laboratory. H. U. Ross.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgical Problems Laboratory. H. U. Ross, W. C. Winegard.
Course 8, IV Year; 2 hrs. laboratory per week, both terms.
Problems dealing with subject matter in subjects 542, 543 and 552.

541. Metallurgy Laboratory. H. U. Ross.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term.
A continuation of subject 535.

542. Non-Ferrous Production Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Extractive metallurgy of the non-ferrous metals, including electrometallurgy.

543. Physical Metallurgy. B. Chalmers.
Courses 5m and 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536.

544. Physical Metallurgy Laboratory. B. Chalmers, W. C. Winegard.
Courses 5m and 8, IV Year; 6hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practical work relating to subject 543.

546. Physical Metallurgy. B. Chalmers, W. C. Winegard.
Course 1, III Year; 2 hrs. lectures per week, first term.
A short course on the influence of heat and mechanical treatment on the structure and properties of steels and the more important non-ferrous alloy.

547. Physical Metallurgy 2. B. Chalmers, W. C. Winegard.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 532.

548. Physical Metallurgy Laboratory. B. Chalmers, W. C. Winegard.
Courses 3 and 11, IV Year, $1\frac{1}{2}$ hrs. laboratory per week, second term.
A practical course illustrating the principles dealt with in subjects 532 and 547.

549. Physical Metallurgy. B. Chalmers, W. C. Winegard.
Courses 5e, 5s, 5i, 5g, 5t and 7, III Year; Courses 2 and 10, IV Year; 1 hr. lecture per week, both terms.
A short course in Physical Metallurgy; stucture of metals and alloys; effects of mechanical distortion and heat treatment on structure; relation between structure and mechanical properties; and properties of some steels and non-ferrous alloys.

550. Metallurgical Theory. The Staff in Metallurgical Engineering.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

552. Ferrous Production Metallurgy. H. U. Ross.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Production metallurgy of iron and steel.

MODERN LANGUAGES

610. English.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, I Year; 2 hrs. lectures per week, both terms.

(*a*) Literature: Shakespeare, King Lear (Crofts); Milton, Samson Agonistes (Crofts); Shaw, Major Barbara (Penguin); Fielding,

Tom Jones (Modern Library): Hardy, Tess of the D'Urbervilles (Macmillan); Ethel Wilson, The Equations of Love (Macmillan); Pope, Selected Poems (Penguin); Eliot, Selected Poems (Penguin); J. S. Mill, On Liberty (Crofts); Matthew Arnold, Four Essays (ed. E. K. Brown—Crofts); George Orwell, Nineteen Eighty-four (Pocket Books). Final examination on these texts.

(*b*) Composition: Study of textbook to be selected by instructor; writing of original compositions: final examination in practical composition.

PHYSICAL EDUCATION

640. Physical Education.
All courses, I and II Years.

PHYSICS

650. Properties of Matter; Mechanics and Heat. G. D. Scott.
Courses 5 and 10, I Year; 3 hrs. lectures per week, both terms.
Text books: Physics, Vol. 1—Shortley and Williams. Principles of Physics, Vol. 1—Sears. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. G. D. Scott, Miss K. M. Crossley.
Courses 5, and 10, I Year; 3 hrs. laboratory per week, both terms: 1 hr. tutorial per week, both terms.
Supplementary to subject 650.

652. Elementary Magnetism and Electricity. R. W. McKay.
Courses 5, 8, and 10, II Year; 2 hrs. lectures per week, both terms.
Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.
Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.
Courses 5, 8, and 10, II Year; 1 hr. lecture per week, both terms.
Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.
Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

655. Physics Laboratory (Magnetism and Electricity and Light).
Course 5, II Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Courses 8, and 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652 and 653.

656. Physics of Solids and Fluids. C. Barnes.

Course 5, III Year; 1 hr. lecture per week, both terms.

Gravitational potential and Laplace's equation. Vibration theory –damped motion, coupled oscillations, etc. Elasticity. Introduction to fluid motion and heat conduction. Differential equations of quantum mechanics.

657. Thermodynamics and Kinetic Theory. D. G. Ivey.

Course 5, III Year; 3 hrs. lectures per week, both terms.

Temperature scales, thermometry, calorimetry. First and Second laws, Entropy and Kelvin Thermodynamic Scale, equations of state, the Virial expansion. Ideal and van der Waal's gases. Specific heats. Thermodynamic functions. Joule-Thomson effect. Radiation and pyrometry up to Wien and Planck Laws. Distribution of velocities. Transport Phenomena. Brownian motion.

659. Physical Laboratory. D. G. Ivey.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term.

Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, W. H. Watson, H. L. Welsh.

Courses 5e, 5i, 5g, 5m, 5s, and 5t, IV Year; 3 hrs. lectures per week, both terms.

Introduction to quantum theory, atomic, molecular and nuclear physics.

665. Physical Laboratory. H. J. C. Ireton.

Course 5s, IV Year; 9 hrs. laboratory per week, both terms.

Course 5m, IV Year; 6 hrs. laboratory per week, both terms.

Accompanying the lecture subjects 663, 666, and 669.

666. Advanced Optics. M. F. Crawford.
Course 5s, IV Year; 2 hrs. lectures per week, both terms.
Diffraction, interference, and polarisation.
Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams. Cours d'Optique—Bruhat.

669. Analysis of Materials by Spectrographic and X-Ray Methods. H. J. C. Ireton.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.
Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. P. N. S. O'Brien.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, thermometric, and radioactive methods.
Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. P. N. S. O'Brien.
Course 9, IV Year; 1 hr. lecture per week, both terms.
Introduction to physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.
Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. P. N. S. O'Brien.
Course 5g, IV Year; 6 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 670.

673. Geophysics. P. N. S. O'Brien.
Course 9, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.
Course 5i, IV Year; 3 hrs. laboratory per week, both terms.
Accompanying subject 663.

675. Physics of the Earth. J. T. Wilson, C. Barnes.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

676. General Physics. J. N. P. Hume.
Courses 6 and 8, I Year; 3 hrs. per week, both terms.
A first course in physics including an introduction to modern conceptions of matter.

677. Physics Laboratory. J. N. P. Hume.
Courses 6 and 8, I Year; 3 hrs. laboratory per week, both terms.
A course designed to accompany subject 676.

PRACTICAL EXPERIENCE

690 Practical Experience.
Course 1.
Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.
Course 2.
Every student in Mining Engineering is required to present before graduation satisfactory evidence of having had at least six months' practical experience of a nature acceptable to the department, in work connected with the Mineral Industry. Instruction regarding the type of work considered acceptable will be given by the department to the students during their first year. Certificate forms may be obtained from the department and the completed certificates should be returned to the department as soon as possible after the completion of each period of work.

692. Practical Experience.
Course 3.
Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

694. Practical Experience.

Course 6.

Every student in Chemical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 800 hours' experience in work connectedwith engineering practice of a nature acceptable to the department.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit before graduation, evidence of having had at least 1200 hours of practical engineering experience satisfactory to the department. Certificate forms may be obtained from the departmental office and the completed certificates should be returned to the department as soon as possible after the completion of each period of work.

696 Practical Experience.

Course 9.

Every student in Applied Geology is required to submit before graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development, underground work or service on geological field parties, and at least half of the time should be spent underground. Forms to be used in submitting experience record are available in the Department of Geological Sciences office.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such

experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, O. J. Marshall, H. L. Macklin, W. H. Carr.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the tape, the transit, and the level, and computation of corrections, azimuths, bearings, latitudes and departures, co-ordinates and areas.

Text book: Surveying—Philip Kissam.

Reference books: Surveying—Philip Kissam. Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed.

712. Field Work. W. M. Treadgold, O. J. Marshall, H. L. Macklin, W. H. Carr, T. L. Rowe, B. J. Haynes, E. A. Guppy, J. Farantatos.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; keeping of field notes; the use of the transit in surveying closed figures and traverse lines; plotting by co-ordinates; computing of areas; instrumental work with the level and calculating the volume of excavations.

714. Surveying. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, compound and spiral curves as applied to highway and railroad surveying. Main features of mine and hydrographic surveying.

Text books: Printed notes—Staff in Surveying. Route Surveys—Skelton.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term, 2 hrs. lecture per week, second term.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying. Practical determination of time, latitude and azimuth by methods adapted to the surveyor's transit.

Text books: Surveying—Breed and Hosmer. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, O. J. Marshall, H. L. Macklin, W. H. Carr, B. J. Haynes.

Course 1, II Year; 3 hrs. per week, second term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and curves.

717. Field Work. H. L. Macklin, O. J. Marshall, W. H. Carr.

Courses 2 and 9, II Year; 2 hrs. per week, second term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling, curves and topography.

718. Construction Surveying. W. H. Carr.

Course 1, III Year; 2 hrs. lectures per week, second term.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

720. Survey Camp. W. M. Treadgold, O. J. Marshall, J. W. Melson, H. L. Macklin, B. J. Haynes, W. H. Carr, G. B. Langford, W. W. Moorhouse.

Courses 1, 2, and 9, III Year: Aug. 17 to Sept. 19—Gull Lake.

Course 1:

(*a*) Secondary Triangulation and Base Line Measurements.

(*b*) Highway and Railway Location.

(*c*) Cross Sectioning and Computation of Earthwork.

(*d*) Stadia and Plane Table Topography.

(*e*) Observations for Time, Azimuth, and Latitude.

Courses 2 and 9:

(*a*) Stadia and Plane Table Topography.

(*b*) Mine Surveying, using overhead stations.

(*c*) Shaft plumbing and use of Auxiliary Telescope.

(*d*) Geological Surveying and mapping.

Students in Courses 1, 2, and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

721. Survey Camp. O. J. Marshall, W. H. Carr.

Course 1_b, IV Year; Aug. 31 to Sept. 19 (3 weeks) Gull Lake.

Triangulation, traverses, levelling and astronomical observations by precise methods.

THESIS

730. Thesis.

Course 1, IV Year; 2 hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instructions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis Seminar.

Course 5, IV Year.

Each student in the Fourth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training for those fields.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the

Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, first term.

Each student must collect suites of rocks and minerals or fossils during the summer vacation preceding the IV Year. This material must be identified and described during the first term, and the report covering this work must be submitted by January 31st of the IV Year.

739. Thesis.

Course 10, IV Year

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course 11, IV Year.

Each student in the Fourth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work in each subject is 50% and a student must obtain a weighted average of 60% in order to pass in the work of the year. He shall be required to pass a supplemental examination in each subject in which he obtains less than 50%. Subjects will be weighted according to the number of hours devoted to them, the hours assigned to laboratory subjects being given one half the weight of those in lecture subjects.

5. Honours and scholarships will be awarded upon the basis of the weighted average.

6. Honours will be awarded to a student, who at the Annual Examinations passes in all written and laboratory subjects and who also obtains a weighted average of 75% on the work of the year.

7. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

8. A student who fails in the work of any year, provided he is otherwise eligible, will be permitted to register provisionally for the purpose of repeating the year.

9. If the performance of a student repeating the First Year is unsatisfactory during the first term, as determined by laboratory marks and written examinations, he may be required to withdraw.

10. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

11. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they failed before presenting themselves a second time for examination.

12. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

13. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

14. A student who has failed to complete satisfactorily the course in Physical Education prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Education prescribed for the Second Year will not be permitted to register in the Fourth Year.

15. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 24th day of August, 1953. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by the order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. MEDALS, PRIZES, SCHOLARSHIPS, BURSARIES AND FELLOWSHIPS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

In order to be eligible for a medal, prize, scholarship, bursary, fellowship or other awards granted solely upon standing obtained at an annual or special examination or upon an essay, or term work, or other academic rating, a candidate must obtain honours at such annual or special examination or upon such essay, term work, or other academic rating unless the statute respecting the award or medal specifies that standing lower than honours may be accepted.

When an award or medal is granted upon standing obtained on part of the work of any academic year the candidate must obtain standing but need not obtain honours in the work of the academic year as a whole, provided he obtains honours in the part concerned, unless the statute respecting the award or medal specifies otherwise.

No medal, prize, scholarship, bursary, fellowship or other award will be granted to a candidate who is conditioned in any subject at an annual examination or in Physical Education unless the statute respecting the award or medal specifies otherwise.

A candidate will not be permitted to receive more than one award in a session unless the statute establishing each of the awards concerned or the Calendar specifies otherwise. Only one of those marked by an asterisk may be held in any one year. A candidate who would, but for this provision, have received more than one award may have his name so published in the class lists.

A candidate who has spent two sessions in any year of an undergraduate course is not eligible to compete for any award at the annual examinations of that year.

Medals, after they have been suitably engraved, will be given without delay to the winners or forwarded to them by registered mail.

Awards granted to members of graduating classes other than awards for graduate study and research, will be paid in one instalment as soon as possible after the granting of the awards.

All other awards will be paid (i) if of the value of $50 or less, in one instalment on November 20 and (ii) if of the value of more than $50 in two equal instalments, the first on November 20 and the second on February 20, in the session following the granting of the awards provided that no payment is made to a candidate (*a*) who is not in regular attendance upon lectures and laboratory classes in the Faculty, or if the Calendar so specifies, in the course in which the award is established or granted (*b*) who does not present at the Chief Accountant's Office before each payment a certificate of attendance upon lecture and laboratory classes signed by two senior members of the staff.

The Senate may, on the recommendation of the Faculty, permit a candidate to whom an award has been granted to postpone attendance upon lectures and laboratory classes for one year. Further postponement may be permitted on application.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries.....	$2000	Yes	No	138
Class of 1937 Engineering Bursary......................	$100	Yes	No	138
Hagarty Memorial Scholarship	$60	Yes	Yes	138
U.T.S. Engineering Scholarship	$250	Yes	Yes	139
The Leonard Foundation Scholarships..............	—	Yes	Yes	139
The Robert Simpson Company Scholarship..............	$100	Yes	Yes	139
O.H.A. War Memorial Scholarship...............	$200	Yes	Yes	140
Engineering Alumni Admission Scholarship...............	$300	Yes	No	140
Students' Administrative Council Admission Scholarship...	$350	Yes	Yes	140

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	141
*Baptie Scholarship...........	—	No	Yes	141
MacLennan-MacLeod Memorial Prize..............	$25	No	No	141
*Ransom Scholarship in Chemical Engineering	$150	No	Yes	142
T. H Bickle Prize...........	$30	No	Yes	142
*John M. Empey Scholarship..	$100	No	No	142
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics.......	$60	No	Yes	143
*Wallberg Undergraduate Scholarships..............	$600	No	No	143
Paulin Memorial Scholarship..	$300	No	Yes	143
*Association of Professional Engineers of the Prov. of Ontario Scholarships(3).....	$225	No	Yes	145
Hugh Gall Award...........	$100	Yes	No	144
University Naval Training Division Bursaries.........	$100	Yes	Yes	144
S. Ubukata Fund............	—	Yes	Yes	144
University of Toronto General Bursaries.................	—	Yes	No	160
Dominion-Provincial Student-Bursaries.................	—	Yes	No	160
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship..........	£400	Yes	No	153
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	141
*Harvey Aggett Memorial Scholarship...............	$75	No	No	145
J. A. Findlay Scholarship.....	—	No	Yes	145
*Association of Professional Engineers of the Province of Ontario Scholarships (3)....	$225	No	Yes	145
T. H. Bickle Prize..........	$30	No	Yes	142

Name	Amount	Application required	Available only to a limited group or single course	See page
Edith Tyrrell Memorial Bursary..................	$300	Yes	Yes	146
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships..............	—	No	Yes	146
*John M. Empey Scholarship..	$100	No	No	142
W. G. Millar Memorial Scholarship...............	$250	Yes	Yes	147
*Wallberg Undergraduate Scholarships..............	$300	No	No	143
Ardagh Prize................	$50	No	Yes	147
James L. Morris Memorial Prize	$60	No	Yes	148
University of Toronto General Bursaries.................	—	Yes	No	160
Dominion-Provincial Student-Aid Bursaries.............	—	Yes	No	160
Scottish Rite Masons Bursary.	$100	Yes	Yes	144
Eastern Steel Products Limited Scholarship...............	$350	Yes	Yes	148
Egerton S. Noble Scholarships (2)	$500	No	No	148
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship..........	£400	Yes	No	153
*Boiler Inspection and Insurance Company Scholarship......	$150	No	Yes	149
University Alumni Federation War Memorial Scholarships.	$250	Yes	No	141
*Jenkins Scholarship in Engineering...............	$200	No	No	149
Heating and Ventilating Engineers Prize................	$50	No	No	149
E.I.C. Prize.................	$25	No	Yes	149
Engineering Society Semi-Centennial Award..........	$75	No	No	150
J. A. Findlay Scholarship.....	—	No	Yes	145
*Association of Professional Engineers of the Province of Ontario Scholarships (3).....	$225	No	Yes	145
T. H. Bickle Prize............	$30	No	Yes	142
Edith Tyrrell Memorial Bursary..................	$300	Yes	Yes	146

Name	Amount	Application required	Available only to a limited group or single course	See page
Archie B. Crealock Memorial Prize	$25	No	Yes	150
*John M. Empey Scholarship	$100	No	No	142
Hudson Bay Mining and Smelting Company Limited Scholarships	$800	Yes	Yes	150
*Wallberg Undergraduate Scholarships	$300	No	No	143
Chemical Institute of Canada Prize	$25	No	Yes	151
Kennecott Copper Corporation Scholarship	$1000	No	Yes	151
RCE Memorial Scholarship	$125	Yes	Yes	152
Geo. W. Crothers Limited Scholarship	$250	Yes	No	150
Charles H.Sage Scholarships(2)	$500	No	No	148
University of Toronto General Bursaries	—	Yes	No	160
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	160
Loan Funds	—	Yes	No	160
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR	—			
B.A.A.S. Medal		No	No	151
Heating and Ventilating Engineers Prize	$50	No	No	149
INCO. Scholarship	$500	Yes	Yes	151
"Second Mile Engineer" Award	$100	No	Yes	152
Henry G. Acres Medal	—	No	Yes	152
Massey-Harris Co. Ltd. Scholarships (2)	$500	Yes	Yes	152
Geo. W. Crothers Limited Scholarship	$250	Yes	No	150
Ontario Section, American Society for Metals Prize	$50	No	Yes	151
University of Toronto General Bursaries	—	Yes	No	160
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	160
Loan Funds	—	Yes	No	160

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO GRADUATES				
Rhodes Scholarship..........	£400	Yes	No	153
1851 Exhibition Science Research Scholarships........	£275	Yes	Yes	154
McCharles Prize.............	$1000	No	No	155
Nipissing Mining Research Fellowships...............	$600	Yes	No	155
H. W. Price Research Fellowship in Electrical Engineering.....................	—	Yes	Yes	156
C.I.L. Fellowship in Chemistry	$1200	Yes	Yes	156
T. A. Russell Memorial Research Fellowship..........	$1000	Yes	Yes	156
Consolidated Mining and Smelting Company Fellowship...	$1000	Yes	No	156
Canadian Lumbermen's Association Timber Research Fellowship................	$1000	Yes	No	157
Imperial Oil Graduate Research Fellowships.........	$4000	Yes	Yes	157
Wallberg Research Fellowships	$3000	Yes	No	157
Arthur Hays Sulzberger Fellowship..................	$1000	Yes	No	157
Babcock-Wilcox and Goldie-McCulloch Limited Fellowship.....................	$1500	Yes	Yes	158
Athlone Fellowships.........	—	Yes	No	158
1940 Toronto Fund..........	—	Yes	No	159
Raymond Priestley Fellowship	£450	Yes	No	159
Royal Institution of Great Britain Science Research Scholarships..............	£350	Yes	No	159

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

In those cases where the amount of the award is not payable from income earned on an endowed fund, payment will be dependent on the receipt of the amount of the annual award from the donor.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $200, will be awarded in 1952 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1952. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

CLASS OF 1937 ENGINEERING BURSARY

The class of 1937 presents annually a bursary of $100 to assist worthy engineering candidates to enter the Faculty. The award is based on the student's high school standing and on his need for financial assistance.

The recipient is selected from applicants for Applied Science Bursaries, and from candidates sponsored by Engineering Counsellors and by members of the Class of 1937.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among

the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School, the Kapuskasing High School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute and Vocational School, from whom further information may be obtained regarding conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidate shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidate shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities

of North Bay, Sudbury, Sault Ste. Marie Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, in the School of Architecture, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent. at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Five scholarships and awards, each of the value of $20.000 will be granted in 1952-53 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of financial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that a scholarship of one half the annual income shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. If in any year no award is made, a second award will be available in a subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open

to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards listed in the Calendar with an asterisk. The awards were first made on the result of the annual examination of 1947.

PAULIN MEMORIAL SCHOLARSHIP

The Paulin Memorial Scholarship, provided through the generosity of Mr. Fred W. Paulin, a graduate of the Faculty in 1907, was established in memory of his brother, John Cameron Paulin, a student in Mining Engineering, who was fatally injured in 1906 during a football practice. The Scholarship which has a value of $300.00, is awarded on the recommendation of the Department of Mining Engineering to a student registered in Mining Engineering, who has successfully completed the work of the First Year

The award is made on the following bases:

(*a*) academic proficiency.

(*b*) qualities necessary for the development of leadership, such as ambition, initiative, resourcefulness and strength of character.

(*c*) he must continue his studies in Mining Engineering during the following session.

The first award was made for the Session 1951-52.

HUGH GALL AWARD

The Hugh Gall Award, of the annual value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946 for a five year period and, through the generosity of Mrs. Hugh Gall extended for a further three year period. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions, has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session. A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

THE SCOTTISH RITE MASONS' BURSARY

The Scottish Rite Masons' Bursary, the gift of the Scottish Rite Masons of Toronto, of the value of $100. is awarded to a student enrolled in the Second Year who is a member of the Masonic Order, or a son, brother, nephew, daughter, sister or niece of a member of the Masonic Order. Consideration will be given to financial need and academic standing. Evidence of connection with the Masonic Order and information regarding financial need must be given with the application which must be submitted to the Secretary of the Faculty.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head

of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering:—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

EDITH TYRRELL MEMORIAL BURSARY

The Women's Association of the Mining Industry of Canada has presented this Bursary, having the value of Three Hundred Dollars, annually, commencing in 1939, and named in memory of their founder and first president, Mrs. Edith Tyrrell. A medal donated by Dr. Tyrrell accompanies the Bursary. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Department of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endownment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course of Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00 is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at

the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examination of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris, C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income from $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the Examinations of the Second Year.

EASTERN STEEL PRODUCTS LIMITED SCHOLARSHIP

The Eastern Steel Products Limited Scholarship of an annual value of $350.00 has been established in the course in Mechanical Engineering for a period of five years.

The Scholarship will be awarded to a student entering the Third Year in Mechanical Engineering who:

(*a*) was registered in the course in Mechanical Engineering in this Faculty in his First and Second Years.

(*b*) obtained Honours in the work of the First and also of the Second Year.

(*c*) gives evidence not only of mental capacity but who also shows leadership ability, and gives promise of becoming a worth while influence in affairs of the profession and the community.

Consideration is given to financial need.

Application must be made to the Secretary of the Faculty not later than March 15.

The first award was made at the Annual Examinations of 1948.

SPRUCE FALLS POWER AND PAPER COMPANY LIMITED SCHOLARSHIPS

The Spruce Falls Power and Paper Company Limited has established four Scholarships of a value of $250.00 each, two in the Second Year known as the Egerton S. Noble Scholarships and two in the Third Year known as

the Charles H. Sage Scholarships. They are awarded on the results of the Annual Examinations of the Second and Third Years to the students who stand first and second at the examinations of their respective years and are open to students in all courses in the Faculty. The first awards were made on the results of the examinations of 1951.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Chief Accountant to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Fifty Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

GEO. W. CROTHERS LIMITED SCHOLARSHIP

Geo. W. Crothers Limited have presented a scholarship of an annual value of $250.00, the first award being made in the Session 1951-52.

The award will be made on the recommendation of a Committee of Award consisting of the Dean of the Faculty, two representatives of the Faculty Council and a representative of the donor on the following basis:

(*a*) The award is open to students registered in the Third or Fourth Years in this Faculty.

(*b*) Consideration will be given to academic achievement, financial need, extra-curricular activities and such other factors as may be appropriate.

(*c*) The scholarship is tenable with other awards.

(*d*) Application must be made to the Secretary of the Faculty not later than 1st November.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Course in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

KENNECOTT COPPER CORPORATION SCHOLARSHIP

The Kennecott Copper Corporation offers a scholarship of a value of $1000.00 annually to a student who has completed three years of the course in Mining Engineering or, in an exceptional case, to a graduate student proceeding to the Degree of Master of Applied Science in Mining Engineering. The award will be made on the following basis.

(*a*) proficiency in engineering studies.
(*b*) leadership, willingness, co-operativeness, initiative and ambition.
(*c*) ability to direct and stimulate others.
(*d*) good health and physique.

The first award was available in 1948.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

A gift of books accompanies the medal.

ONTARIO CHAPTER, AMERICAN SOCIETY FOR METALS PRIZE

The Ontario Chapter, American Society for Metals offers a prize of $50.00 to a student registered in the graduating class in Metallurgical Engineering. The award is made annually, commencing 1951, on the recommendation of the staff in the Department of Metallurgical Engineering, primarily on the basis of a Thesis on either physical or extractive metallurgy. The prize may be held along with any other award.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgy Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

R.C.E. MEMORIAL SCHOLARSHIP

The Memorial Fund Committee of the Royal Canadian Engineers has established the R.C.E. Memorial Scholarship of a value of One Hundred and Twenty-five Dollars, open to students who have successfully completed their second to last year in the Faculty of Applied Science and Engineering or the School of Architecture. A candidate must be a member in good standing of the Canadian Officers' Training Corps and have successfully completed one summer season's training. Selection is made on the basis of academic standing and of qualities of leadership.

Application forms may be obtained at the C.O.T.C. Orderly Room, 119 St. George St.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special enphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

MASSEY-HARRIS COMPANY LIMITED SCHOLARSHIPS

The Massey-Harris Company Limited has established two scholarships each of an annual value of $250.00, to be awarded on the recommendation of the Council of the Faculty of Applied Science and Engineering to students registered in the Fourth Year of the Courses in Mechanical Engineering or Engineering and Business. In making the award academic achievement, financial need, extra-curricular activities and such other factors as may be deemed appropriate will be taken into consideration.

Application should be made to the Secretary of the Faculty not later than 15th October.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric

Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power developments at Shipshaw on the Saguenay River, which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer for award in the Province of Ontario two out of ten of the Rhodes Scholarships for Canadians, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year given conditionally at Oxford or elsewhere abroad may be authorized in proper cases.

Each candidate must be a British subject with at least five years domicile in Canada and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year *for* which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

A candidate may apply either for the province in which he has his private home or residence, or for the province in which he has taken his university course.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or

personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., K.C., 5 Rosedale Road, Toronto 5, General Secretary for the Rhodes Scholarships in Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey or the appropriate provincial secretary on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be ineligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Dean MacFarlane, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

MCCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award.

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time as recommended by the School of Engineering Research, to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $1,200.00 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $1000 for a research in some field of pure or applied science; an additional amount of $200 is available for special equipment and supplies. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four Graduate Research Fellowships now having a potential value of $3,750.00 each ($1,250.00 a year payable in Canadian funds for a maximum of three years). The fellowships are open to graduates of any approved University in Canada and are offered for graduate study leading to a Master's or Doctor's degree in the fields of Chemistry and/or Engineering (two fellowships), Geology (one fellowship), and Economics or Industrial Relations (one fellowship). Nomination of students for the fellowships is made by the University—such nominations to be received by Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st of each year. Nomination forms and information as to the terms of the fellowships are obtainable at the Registrar's Office.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships of the value of $1,500 each are open to graduates of any recognized university who propose to pursue advanced study and research in any branch of Engineering in the University of Toronto.

Forms of application may be obtained from the Secretary of the School of Graduate Studies. These should be returned together with a transcript of academic record and an outline of the proposed study and research not later than March 1st.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIP

The Spruce Falls Power and Paper Company Limited has established the Arthur Hays Sulzberger Fellowship for the encouragement of research in the Faculty, of an annual value of $1,000.00. It is open to graduates of the University of Toronto or of other recognized universities,

but is restricted to Canadian Citizens. Application should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

BABCOCK-WILCOX AND GOLDIE-MCCULLOCH LIMITED FELLOWSHIP

Babcock-Wilcox and Goldie-McCulloch Limited have established a Fellowship of the value of $1500.00 annually to be awarded preferably for research in connection with a subject relating to Mechanical Engineering. The holder of the fellowship must be registered in the School of Graduate Studies of this University proceeding to an advanced degree. The award is made on the recommendation of the Council of the Faculty of Applied Science and Engineering and is open to graduates in engineering of any recognized University. The first award was made for the Session 1951-52.

Application must be made to the Secretary of the School of Graduate Studies not later than 1st March. The application must be accompanied by an official transcript of the applicant's undergraduate record and may outline a proposed study and research.

THE ATHLONE FELLOWSHIPS

His Majesty's Government in the United Kingdom have established a number of fellowships to be awarded annually to enable Canadian engineering graduates to take postgraduate training in the United Kingdom. These became available in 1951 when five fellowships were open to graduates of the University of Toronto immediately after graduation. Additional fellowships are for award to graduates who have already spent some time in industry. The fellowships cover costs of transport, fees and maintenance and are normally tenable for a period of two years. They may be utilized for (*a*) works training in industry, (*b*) postgraduate university study, or (*c*) a combination of these. Candidates must be Canadian citizens or British subjects normally resident in Canada and should preferably be less than 27 years of age. Further information and application forms may be obtained from the Secretary of the Faculty.

THE UNIVERSITY OF MANCHESTER TORONTO FUND

The University of Manchester has accepted the gift of a sum of £1,699 from a Committee representing the parents of children who during the war were evacuated to Toronto and other places in Canada. The capital and any income arising therefrom will be used to make grants to Canadians wishing to conduct post-graduate studies and/or research in the University of Manchester, preference being given to students who have graduated from the University of Toronto. The total amount of grant or grants to any student will not exceed £100. Applications must be submitted to the Registrar of the University of Toronto on or before January 1st of the year in which the applicant wishes to enter the University of Manchester, together with transcripts of undergraduate and graduate record and outlines of the post-graduate studies and/or research to be followed at the University of Manchester.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham. The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are

requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. To be eligible, students must have obtained not less than sixty-six per cent. at their last annual examination. Further information may be obtained from the Secretary of the Faculty.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty.

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.
S.A.E.—Canadian Section Loan Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual

income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SOCIETY OF AUTOMOTIVE ENGINEERS—CANADIAN SECTION LOAN FUND

The Society of Automotive Engineers—Canadian Section has established a loan fund of $300.00 in the Faculty of Applied Science and Engineering. Preference is given to students in good scholastic standing and engaged in studies relative to the automotive and aircraft industries, and to students in fourth, third and second years in that order. Particulars may be obtained from the Secretary of the Faculty.

SECTION XII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of its own students in respect of all matters arising or occurring in or upon its respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1952-53

Year	1	2	3	5	6	7	8	9	10	11	Total
I	103	17	99	54	113	89	17	29	23	77	621
II	73	7	65	40	64	53	8	9	12	44	375
III	47	5	63	14	52	51	6	4	2	42	286
IV	65	10	61	17	65	65	2	5	6	29	325
	288	39	288	125	294	258	33	47	43	192	1607

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UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science and Engineering

1954-1955

THE UNIVERSITY OF TORONTO PRESS
1954

CALENDAR 1954

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SECTION I. CALENDAR 1954-1955

FALL TERM, 1954

July 1	*Thursday*	Dominion Day. Buildings closed.
July 15	*Thursday*	Last day for receiving applications for supplemental examinations.
August 2	*Monday*	Civic Holiday. Buildings closed.
August 16	*Monday*	Students of the III Year, Courses 1, 2, and 9 report at Survey Camp.
August 23	*Monday*	Supplemental Examinations commence.
September 1	*Wednesday*	Last day for receiving applications for admission to the I Year.
September 6	*Monday*	Labour Day. Buildings closed.
September 9	*Thursday*	Special meeting of Faculty Council.
September 16-18	*Thursday-Saturday*	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m. (Saturday 9.30 a.m. to 12 noon) at 119 St. George Street.
September 20	*Monday*	Registration in person of the II and III Years from 9.30 a.m. to 12 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building.
September 21	*Tuesday*	Registration in person of the IV Year from 9.30 a.m. to 12 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building. Dean's address to the I Year. Preliminary instruction to the I Year. Meeting of Faculty Council.
September 22	*Wednesday*	Lectures and laboratory work commence at 9.00 a.m. The opening address by the President to the students of all Faculties at 3.45 p.m., in Convocation Hall.
October 5	*Tuesday*	Meeting of Faculty Council.
October 8	*Friday*	Meeting of Senate.
*October 11	*Monday*	Thanksgiving Day. Buildings closed.
November 3	*Wednesday*	Meeting of Faculty Council.
November 5	*Friday*	General Meeting of Engineering Society.
November 11	*Thursday*	Remembrance Day Service at 10.45 a.m. Lectures and laboratory classes withdrawn from 10.00 a.m. to 12 noon.
November 12	*Friday*	Meeting of Senate.
December 2	*Thursday*	Meeting of Faculty Council. General Meeting of Engineering Society.

December 10	*Friday*	Meeting of Senate.
December 17	*Friday*	Term ends at 5.00 p.m.
December 25	*Saturday*	Christmas Day. Buildings closed.

SPRING TERM, 1955

January 1	*Saturday*	New Year's Day. Buildings closed.
January 3	*Monday*	Spring Term begins. Mid-session Examinations commence.
January 10	*Monday*	Meeting of Faculty Council.
January 14	*Friday*	Meeting of Senate.
January 15	*Saturday*	Last day for receiving the second term instalment of fees.
January 26	*Wednesday*	General Meeting of Engineering Society.
February 1	*Tuesday*	Meeting of Faculty Council.
February 11	*Friday*	Meeting of Senate.
February 18	*Friday*	Engineering Society Annual Elections.
March 1	*Tuesday*	General Meeting of Engineering Society.
March 2	*Wednesday*	Meeting of Faculty Council.
March 11	*Friday*	Meeting of Senate.
April 4	*Monday*	Meeting of Faculty Council.
April 7	*Thursday*	Term ends at 5.00 p.m.
April 8	*Friday*	Good Friday. Buildings closed.
April 12	*Tuesday*	Annual Examinations commence.
April 14	*Thursday*	Meeting of Senate.
May 4	*Wednesday*	Meeting of Faculty Council.
May 13	*Friday*	Meeting of Senate.
*May 23	*Monday*	Victoria Day. Buildings closed.
May 25, 26, 27	*Wednesday* *Thursday* *Friday*	University Commencement.

* Or such other date as may be determined by Order-in-Council.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . Sidney Smith, Q.C., M.A., LL.B., LL.D., D.C.L., F.R.S.C.

Vice-President . . . . C. T. Bissell, M.A., PH.D.
Registrar . . . . J. C. Evans, B.A.
Librarian . . . . W. S. Wallace, M.A., LL.D., F.R.S.C.
Warden of Hart House . . . . J. McCulley, M.A.
Director of University Extension . . . . J. R. Gilley, B.A.SC.

Comptroller . . . . A. G. Rankin, B.COM. C.A.
Bursar and Secretary to the Board of Governors C. E. Higginbottom, F.C.I.S.
Superintendent of Buildings and Grounds . . . A. D. LePan, B.A.SC.
Chief Accountant . . . . D. J. Reid

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Director of University Health Service
G. E. Wodehouse, M.C., M.D., F.R.C.P.
Assistant Director of University Health Service—Women
Miss F. H. Stewart, B.A., M.D.
Director of Athletics and Physical Education—Men . W. A. Stevens, B.S.
Director of Athletics and Physical Education—Women Miss Z. Slack, B.A.
Director of the University of Toronto Press . . . . M. Jeanneret, B.A.
General Secretary-Treasurer of the Students' Administrative Council
E. A. Macdonald, B.A.
Associate Secretary of the Students' Administrative Council
Miss A. E. M. Parkes, B.A.
Director of Hart House Theatre . . . . R. S. Gill, M.A.
Director of the Placement Service . . . J. K. Bradford, O.B.E., M.A.SC.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . . . K. F. Tupper, O.B.E., B.A.SC., S.M. (MICH)
Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.
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1953–54

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SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture. On July 1, 1948, the School of Architecture was separated from the Faculty and became an independent School with its own Director and Council.

With the end of the Second World War during the summer of 1945 the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors and the President, the University leased from the Crown part of the large shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in the First Year and 1500 in the Second Year. In the 1947-48 session the enrolment at Ajax consisted of 1200 students in the First Year and 1400 in the Second Year. In the session 1948-49, 600 were registered at Ajax in the First Year and 975 in the Second Year. All other instruction was given in Toronto.

To provide for this self-contained University community at Ajax, there were 446 acres and 111 buildings. The University operated such services as central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence, in 1947-48 there were 1800 students and in 1948-49 there were 900. Student life at Ajax compared favourably with that in Toronto, excellent accommodation being provided for a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

With the completion of the Wallberg Building and the extension of the Mechanical Building, additional accommodation became available on the Queen's Park Campus, and this fact coupled with the decrease in numbers entering each year brought about the closing of Ajax on May 31, 1949.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

GENERAL

1. Candidates for admission in 1954 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

Students from foreign countries must, in addition to providing the necessary equivalent certificates, give evidence of their ability to understand lecture and laboratory courses where the English language is used exclusively, and must demonstrate their ability to use this language in both the spoken and written form, with reasonable facility. Such students are strongly advised to spend a year in Grade XIII of an Ontario Secondary School before seeking admission to this Faculty.

3. Requirements for applicants presenting Ontario certificates.

Grade XIII

Standing is required on nine examinations as follows:

English:	Literature	
	Composition	
Mathematics:	Algebra	
	Geometry	
	Trigonometry	
Science:	Chemistry	
	Physics	
One of:	French	*Authors and Composition*
	German	
	Greek	
	Italian	
	Latin	
	Spanish	

To be admitted a candidate must have an average of not less than Second Class Honours on at least five of the nine examinations on which standing is required.

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are advised to select German as one of the admission subjects.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Grade XIII certificate, generally known as Senior Matriculation, may be accepted in so far as they meet the admission requirements of the University of Toronto in subjects and percentages and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

QUEBEC

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

MANITOBA, SASKATCHEWAN, ALBERTA

Junior (Grade XI) and Senior (Grade XII) Matriculation certificate.

BRITISH COLUMBIA

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

NEW BRUNSWICK, NEWFOUNDLAND, NOVA SCOTIA, PRINCE EDWARD ISLAND

Junior and Senior Matriculation Certificates of the Common Examining Board or of their respective Departments of Education. Second and Third Year Certificates of Prince of Wales College are also accepted from Prince Edward Island.

ENGLAND AND WALES

Passes in the General Certificate of Education in the following subjects: English Language, English Literature, a mathematical subject, Physics, Chemistry and a language other than English. Passes at Advanced level must be obtained in a mathematical subject and in either Physics or Chemistry.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 7th to 22nd (Saturdays September 11th and 18th, 9 a.m. to 12 noon), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the sèssion. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

Schedule of Fees

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
			Men		
I-IV............	$450	$41	$491	$266	$228
			Women		
I-IV............	$450	$23	$473	$248	$228

*The Academic Fee includes the following fees:—
Tuition; Library and Laboratory Supply; one Annual Examination; Laboratory Fee; Physical Education; and Degree.

†These Incidental Fees include the following fees:—
For men—Hart House; Students' Administrative Council; Athletic; Health Service; Engineering Society; Faculty Athletic Association.
For women—Students' Administrative Council; Athletic; Health Service; Engineering Society.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

SUMMARY OF STUDENTS' EXPENSES

11. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 25
2. Board and Lodging, per week.................. $15 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8),
Applied Geology (Course 9),
Aeronautical Engineering (Course 10),
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the above courses.

3. The courses extend over four academic years. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Electrical Engineering, and Applied Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering may proceed to post-graduate and professional degrees. The post-graduate degrees are M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and Scholarships for graduate students are available in limited number as shown on page 135. Many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula, effective with the session 1944-45. The subjects that are considered to belong to the liberal system, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked

with the graduate courses and with the work of the School of Engineering Research (page 29).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, and Doctor of Philosophy, see the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (see subject 690.)

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above-mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	284	–	9	–	6
Least Squares	494	–	–	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Education	640	–	2	–	2
Practical Astronomy	200	1	–	2	–
Practical Experience	690	–	–	–	–
Surveying	714, 716	1	3	1	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	-	1	-
Cements and Concrete	35, 44	1	3	1	-
Structural Engineering	28	2	-	2	-
Engineering Problems and Drawing	297	-	9	-	9
Business	310	-	-	1	-
Construction Surveying	718	-	-	2	-
Control Surveys and Mapping	201	-	-	1	-
Differential Equations	507	1	-	1	-
Engineering Geology	382, 383	2	1	2	2
Heat Engines, Theory	427, 428	1	-	1	2
Hydraulics	440, 441	2	-	2	3
Machinery	463, 464	2	3	-	-
Modern World History	324	2	-	-	-
Photogrammetry	75	1	-	-	-
Physical Metallurgy	546	2	-	-	-
Political Science	323	-	-	2	-
Practical Experience	690	-	-	-	-
Survey Camp	720	-	-	-	-

Students in Civil Engineering are required to state not later than June 30th following the completion of their Third Year the options they desire to pursue in the Fourth Year. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

Fourth Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Law	314	1	–	–	–
Hydraulics	445, 446	2	3	2	3
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Municipal Administration and Contracts	216	2	–	–	–
Philosophy of Science	326	2	–	–	–
Practical Experience	690	–	–	–	–
Profession of Engineering	327	–	–	½	–
Sanitary Engineering	214, 215	1	3	1	3
Thesis	730	–	–	–	1
Transportation Engineering	217	1	–	1	–
And either of the following groups of subjects:					
Group A					
Mechanics of Materials	38	–	3	–	3
Reinforced Concrete	41, 37	1	1½	1	1½
Soil Mechanics and Foundations	40, 50	2	–	1	3
Structural Design	43, 299	2	3	1	3
Theory of Structures	36, 37	2	1½	2	1½
Group B					
Adjustment of Observations	523	–	–	–	3
Astronomy	202, 203	1	3	–	–
Geodesy	204, 205	–	–	2	3
Photogrammetry	77, 78	2	3	1	3
Structural Engineering	46, 300	2	–	2	3
Survey Camp	721	–	–	–	–
Town and Regional Planning	218, 219	2	3	–	–

MINING ENGINEERING

(Course 2)

The course in Mining Engineering provides a broad training in the fundamentals of engineering.

The graduate is therefore well prepared to enter any of the many phases of the mineral industry such as the exploration and development of new mineral areas, the mining of mineral deposits by both surface and underground methods, and the milling and metallurgical treatment of the ores and products. The field of the engineer in the mining of precious metals, copper, lead, zinc and nickel in Canada is now augmented by the production of iron, titanium and uranium. Engineering is also increasingly important in the mining and treatment of industrial minerals such as asbestos, limestone and gypsum. Moreover, the expanding world market for mineral products is necessitating the utilization of ore deposits which require the application of the most advanced technological methods.

The course in Mining combines in well balanced proportions, studies in the fields of mathematics, geology, chemistry, structures, mechanics, electricity, metallurgy, and economics and business, together with courses having particular reference to mining. In view of the large proportion of mining graduates employed in production and supervision, the administrative viewpoint is emphasized throughout the course.

With such diversified training, the Mining Engineer is capable of successful participation in all branches of industry and commerce.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 275	2	1	2	1
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	4	–	5
English	610	2	–	2	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining	165	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	691	–	–	–	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	6	–	–
Chemistry	224	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Problems and Drawing	285	–	6	–	6
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	3
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	-	-	-
Oral Expression	193	-	-	-	2
Physical Education	640	-	2	-	2
Practical Experience	691	-	-	-	-
Surveying	715, 717	1	3	2	2
Theory of Measurements	190	1	-	-	-

Third Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Business	310	-	-	1	-
Cements and Concrete	35	1	-	1	-
Elementary Structural Engineering	29	1	-	1	-
Engineering Problems and Drawing	298	-	-	-	3
Heat Engines, Theory	427, 428	1	1½	1	-
Hydraulics	440, 441	2	1½	-	-
Metallurgy	530	1	-	-	-
Mineral Dressing	180, 182	2	-	2	6
Mining	168	2	-	-	-
Mining Laboratory	169	-	3	-	2
Modern World History	324	2	-	-	-
Political Science	323	-	-	2	-
Practical Experience	691	-	-	-	-
Structural Geology	397, 398	1	3	1	3
Summer Essays	192	-	2	-	-
Survey Camp	720, 409	-	-	-	-
Wet Analysis	162	-	3	-	3

Fourth Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Glacial Geology	384, 412	1	–	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Operation and Management	170, 172	2	2	2	6
Mine Ventilation	175, 176	2	3	–	–
Mining Geology	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Ore Dressing	183, 184	1	6	1	–
Physical Metallurgy	549	1	–	1	–
Practical Experience	691	–	–	–	–
Precambrian Geology	403	2	–	–	–
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	2	–	–	–
Thesis	731	–	5½	–	6

MECHANICAL ENGINEERING

(Course 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similiar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

The Calendar of the School of Graduate Studies should be consulted for details.

Graduate work leading to an advanced degree in the administrational or business aspects of engineering is also available in the Department of Mechanical Engineering. The thesis subject chosen for this purpose must be in the technological field and intending applicants are advised to obtain the approval of the Head of the Department of Mechanical Engineering before selecting their thesis topics.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	2	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	6	–	6
English	610	2	–	2	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Education	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	–	–	2	1½
Calculus	491	2	–	2	–
Dynamics	22	–	–	2	–
Economics	311	2	–	2	–
Electricity	338, 334	2	3	–	–
Engineering Chemistry	226	2	–	–	–
Engineering Problems and Drawing	286	–	6	–	6
Heat Engines, Elementary	420	–	–	2	–
Mechanical Engineering	461, 480	2	3	2	3
Mechanics of Materials	23, 31	2	3	2	–
Physical Education	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines	465, 466	3	–	3	–
Treatment of Technical Data	449	–	–	3	–

THIRD YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Business	310	-	-	1	-
Differential Equations	507	1	-	1	-
Electronics	345, 346	2	1½	-	-
Electrical Machines	377, 378	2	1½	2	3
Elementary Structural Engineering	29, 298	1	3	1	3
Heat Engineering	422	2	-	2	-
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	-	2	3
Machine Design	467, 468	2	6	2	6
Modern World History	324	2	-	-	-
Physical Metallurgy	532	2	-	-	-
Political Science	323	-	-	2	-
Practical Experience	692	-	-	-	-

FOURTH YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Law	314	1	-	-	-
Heat Engine Laboratory	426	-	5	-	5
Heat Power Engineering	424	2	-	2	-
Physical Metallurgy II	547, 548	1	-	1	1½
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	-	1	-
Internal Combustion	425	1	-	1	-
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	-	-	1½	-
Philosophy of Science	326	2	-	-	-
Practical Experience	692	-	-	-	-
Profession of Engineering	327	-	-	½	-
Structural Engineering	46, 300	2	3	-	-
Thesis	732	-	1	-	3

ENGINEERING PHYSICS

(Course 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 130 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 114.

GRADUATE STUDY

Graduates of this University, or of another University of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students with the necessary qualifications wishing to pursue further studies, may proceed to the M.A.Sc. and Ph.D. in the Departments of Engineering Physics, Electrical Engineering, Mechanical Engineering, Aeronautical Engineering, Metallurgical Engineering or, to the M.A. and Ph.D. in the Department of Physics.

The requirements and programme will be arranged through the Department concerned.

For further information see the Calendar of the School of Graduate Studies.

First Year Subjects Course 5	Subject No	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3	–	3	–
Analytical Geometry	503	2	–	2	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	279	–	3	–	3
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	3	4	3	4
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry of Space	506	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits	354, 356	2	1½	2	1½
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	2	–	–	–
Physics Laboratory	655	–	6	–	3
Physical Education	640	–	2	–	2

Third Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Electronics	366, 379	2	–	2	3
Machine Design	471, 472	1	3	1	3
Modern World History	324	2	–	–	–
Physical Laboratory	659	–	3	–	3
Physics of Solids and Fluids	656	1	–	1	–
Political Science	323	–	–	2	–
Thermodynamics and Kinetic Theory	657	3	–	3	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5e Electricity					
Electrical Machines	377, 378	2	3	2	3
Physical Metallurgy	549	1	–	1	–
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Geometrical Optics	660, 661	1	3	1	–
Physical Metallurgy	549	1	–	1	–
Option 5g, Geophysics					
Engineering Geology	382, 383	2	1	2	2
Physical Metallurgy	549	1	–	1	–
Option 5t, Thermodynamics					
Heat Engineering	422, 423	2	3	2	3
Hydraulics	450	1	–	1	–
Physical Metallurgy	549	1	–	1	–
Option 5m, Physical Metallurgy					
Physical Metallurgy	536, 537	2	3	2	3

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5e, Electricity					
Acoustics	97, 98	2	1½	–	–
Atomic Physics	663	3	–	3	–
Circuit Analysis	351	2	–	2	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Engineering Electronics	357, 358	2	1½	1	1½
Transmission at Low and High Frequency	352	3	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Ultra-High Frequency Communication	371, 372	–	–	2	1½
Option 5s, X-Rays and Spectroscopy					
Analysis of Materials by Spectrographic and X-Ray Methods	669	1	–	1	–
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	2	–	2	–
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	9	–	9
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5g, Geophysics					
Atomic Physics	663	3	–	3	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 672	2	6	2	6
Mineralogy and Lithology	386, 387	2	2	2	2
Mineral Deposits	399	2	–	2	–
Mining Geology	405	–	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	397, 398	1	3	1	3
Thesis Seminar	733	–	–	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics	89, 90	2	3	2	6
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	2	–	–	–
Photometry and Illumination Design	95, 96	2	3	2	6
Physical Laboratory	674	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5t, Thermodynamics					
Atomic Physics	663	3	–	3	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Machines	377, 378	2	3	2	3
Heat Engineering Laboratory	426	–	6	–	6
Heat Power Engineering	430	1	–	1	–
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	–	1	–
Machine Design	478	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	3
Vibration Engineering	99, 100	1	3	1	–

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5m, Physical Metallurgy					
Atomic Physics	663	3	–	3	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Modern Political and Economic Trends	325	–	–	1½	–
Morphological Crystallography	390	1	–	1	–
Operational Methods	364	2	–	2	–
Physical Metallurgy	543, 544	2	3	2	3
Philosophy of Science	326	2	–	–	–
Physical Laboratory	665	–	6	–	6
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(COURSE 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more useful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical literature. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Chemical Engineering is required to submit satisfactory evidence of having had 800 hours' practical experience. (See subject 694).

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

The Calendar of the School of Graduate Studies should be consulted or details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 280	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 280	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	280	–	6	–	3
English	610	2	–	2	–
General Physics	676, 677	3	3	3	3
Physical Education	640	–	2	–	2
Practical Experience	694	–	–	–	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	229	–	–	–	–
Calculus	491, 287	2	1½	2	1½
Chemical Laboratory	232	2	9	–	9
Economics	311	2	–	2	–
Electrical Engineering	375, 376	2	3	2	3
Industrial Chemistry	230	3	–	–	3
Inorganic Chemistry	231	2	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234	–	–	3	–
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	694	–	–	–	–

Third Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	242	2	–	2	3
Chemical Laboratory	249	–	6	–	6
Chemical Theory	240	3	–	3	–
Differential Equations	507	1	–	1	–
Electrochemistry	246, 247	2	1½	–	–
Heat Engines, Theory	431, 423	2	–	–	3
Industrial Chemistry	241	–	–	3	–
Modern World History	324	2	–	–	–
Organic Chemistry	244, 245	2	9	2	6
Political Science	323	–	–	2	–
Practical Experience	694	–	–	–	–
Public Speaking	319	1	–	1	–

Fourth Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	2	2	2	2
Chemical Engineering Thermodynamics	256	2	–	2	–
Chemical Engineering Laboratory	251	–	12	–	–
Fluid Mechanics	452, 453	2	3	–	–
Industrial Management	318	1	–	1	–
Machine Design	479, 470	2	–	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Organic Chemistry	257	1	–	1	–
Philosophy of Science	326	2	–	–	–
Profession of Engineering	327	–	–	½	–
Public Speaking	319	1	–	1	–
Thesis	734	–	3	–	17

ELECTRICAL ENGINEERING

(Course 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

For the degree of Master of Applied Science at least one year of full-time study is required. From one-half to two-thirds of this time is devoted to lecture subjects in advanced studies chosen according to instructions contained in the Calendar of the School of Graduate Studies. The remainder is devoted to a research project for which a thesis must be submitted.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	-	2	-
Dynamics	21, 275	1	1	2	1
Electricity	330	2	-	2	-
Engineering Problems and Drawing	275	-	6	-	6
English	610	2	-	2	-
Mechanical and Thermal Measurements	448	1	-	1	-
Physical Education	640	-	2	-	2
Practical Experience	695	-	-	-	-
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	-	-

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491, 288	2	3	2	3
Dynamics	22	1	-	1	-
Economics	311	2	-	2	-
Electrical Fundamentals	333	2	-	2	-
Electrical Laboratory	334	-	-	-	6
Electricity	332	2	-	2	-
Elementary Heat Engines	420	1	-	-	-
Elementary Machine Design	462	-	-	2	-
Engineering Chemistry	226	2	-	-	-
Engineering Problems and Drawing	288	-	6	-	3
Mechanics of Materials	23, 31	2	3	2	-
Physical Education	640	-	2	-	2
Practical Experience	695	-	-	-	-

Third Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Problems	335	–	2	–	4
Electrical Laboratory	344	–	3	–	3
Electronics	337	2	–	2	1½
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	3	2	–
Machine Design	475, 468	2	–	2	3
Mathematical Applications in Electricity Engineering	336	2	–	2	–
Modern World History	324	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	–	–	2	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	4½	–	1½
Electrical Problems and Seminar	359	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	1½	1	1½
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	3	–	–	–
And one of the following groups of subjects:					
Group A					
Acoustics	82, 83	–	–	2	1½
Communications II	362, 363	–	–	3	3
Ultra-High Frequency Communications	371, 372	–	–	2	1½
Group B					
Alternating-Current Machinery II	369, 370	–	–	2	1½
Electric Power Systems	373	–	–	2	2
Illumination	93, 94	–	–	2	3

METALLURGICAL ENGINEERING

(Course 8)

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

Both physical and extractive metallurgy are based upon the sciences of chemistry and physics. It is believed that a wider knowledge of the basic sciences will bring to the student a readier appreciation of the technical problems with which he will be later confronted and a greater facility in their solution. To achieve this end, greater emphasis is placed upon physics and chemistry in the earlier years of the course. It follows that this course will be of greater value to students who have obtained a good standing in mathematics and science. In addition to instruction in extractive and physical metallurgy, engineering subjects are provided to give a general knowledge of mechanics of materials, machine design, etc. The course includes the non-technical subjects, such as Economics and English, which are common to all courses in the Faculty.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical Metallurgy courses cover the structure and properties of alloys, including microscopic, x-ray and mechanical methods of investigation.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 113.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 280	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 280	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	280	–	6	–	3
English	610	2	–	2	–
General Physics	676, 677	3	3	3	3
Physical Education	640	–	2	–	2

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	228	–	4	–	4
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Electrical Engineering	375, 376	2	3	2	3
Engineering Problems and Drawing	289	–	3	–	3
Inorganic Chemistry	231	2	–	1	–
Mechanics of Materials	23,31	2	3	2	–
Metallurgy	530	1	–	1	–
Optics	72, 73	1	3	1	3
Physical Chemistry	236	2	–	2	–
Physical Education	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Differential Equations	507	1	–	1	–
Electric Circuits	354, 356	2	1½	2	1½
Electrochemistry	246, 247	1½	3	–	–
Metallurgical Problems Laboratory	531	–	2	–	2
Metallurgical Theory	533	2	–	2	–
Mineral Dressing	180	2	–	2	–
Modern World History	324	2	–	–	–
Morphological Crystallography	390	1	–	1	–
Political Science	323	–	–	2	–
Principles of Extractive Metallurgy	534, 535	2	3	1	6
Principles of Physical Metallurgy	536, 537	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgical Theory	550	1	–	1	–
Metallurgical Problems Laboratory	540	–	2	–	2
Metallurgy Laboratory	541	–	6	–	–
Modern Political and Economic Trends	325	–	–	1½	–
Non-Ferrous Production Metallurgy	542	2	–	2	–
Ore Dressing	182, 183	1	–	1	6
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	543, 544	2	6	2	3
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	736	–	4	–	7

APPLIED GEOLOGY

(Course 9)

The course in Applied Geology is designed for those who wish to enter the field of applied geology. It provides a training in the fundamentals of the geological sciences, and a graduate in this course will be suitably trained to enter any of the branches of geology such as mining geology, engineering geology, petroleum geology, or field and exploration work for mining and oil companies.

The first year of the course in Applied Geology is identical with that in Mining Engineering. In the remaining years, while the emphasis is on geology, instruction is also given in the allied engineering fields. In this way the student in Geology is given a basic engineering training and an understanding of the extractive industries of mining and metallurgy.

The geological courses in the first and second years cover the general fields of physical geology, historical and stratigraphic geology, and minerals and rocks. The third and fourth years are spent in concentrated work on specialized topics as ore deposits, petroleum and structural geology, palaeontology, microscopic study of rocks and ores, Precambrian geology, glacial geology, mining geology, geology of Canada, and geophysics.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 113.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Applied Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a M.A.Sc. or Ph.D.

Work for such degrees will include the preparation of a thesis on an approved subject, together with the study of advanced courses.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Applied Mechanics	26	2	–	2	–
Calculus	490, 275	2	1	2	1
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	269	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	275	–	4	–	5
English	610	2	–	2	–
Physical Geology	380, 381	2	2	2	2
Mechanical and Thermal Measurements	448	1	–	1	–
Mining	165	–	–	2	–
Physical Education	640	–	2	–	2
Practical Experience	696	–	–	–	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	6	–	–
Chemistry	224	2	–	–	–
Economics	311	2	–	2	–
Electric Circuits and Machines	347, 348	1	–	1	3
Engineering Problems and Drawing	290	–	3	–	3
Geological Field Trips	410	–	–	–	–
Heat Engines, Elementary	420	1	–	–	–
Historical and Stratigraphical Geology	393, 394	2	2	2	2
Mechanics of Materials	23, 31	2	–	2	1
Mineralogy and Lithology	386, 387	2	2	2	2

Second Year Subjects Course 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	-	-	-
Oral Expression	193	-	-	-	2
Physical Education	640	-	2	-	2
Practical Experience	696	-	-	-	-
Surveying	715, 717	1	3	2	2
Theory of Measurements	190	1	-	-	-

Third Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	160, 161	1	3	1	3
Business	310	-	-	1	-
Descriptive Mineralogy	388	-	2	-	2
Elementary Geochemistry	385	2	-	2	-
Geological Field Trips	411	-	-	-	-
Metallurgy	530	1	-	-	-
Mineral Dressing	186	2	-	-	-
Mining	168	2	-	-	-
Modern World History	324	2	-	-	-
Ore Microscopy	389	-	-	-	3
Palaeontology	395, 396	2	2	2	2
Petrology	391, 392	3	2	2	2
Political Science	323	-	-	2	-
Practical Experience	696	-	-	-	-
Structural Geology	397, 398	1	3	1	3
Survey Camp	720, 409	-	-	-	-

Fourth Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Descriptive Mineralogy	388	–	2	–	2
Engineering Economics	313	–	–	1	–
Geology of Canada	401	1	–	1	–
Geological Field Trips	412, 413, 414	–	–	–	–
Geophysics	671, 673	1	3	1	3
Glacial Geology	384	1	–	1	–
Metallurgy	538	1	–	1	–
Mine Operation and Management	170, 172	2	–	2	6
Mining Geology	405, 406	–	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Petroleum Geology	407, 408	2	–	2	3
Practical Experience	696	–	–	–	–
Precambrian Geology	403, 404	2	2	–	2
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	2	–	–	–
Thesis	738	–	6	–	–

AERONAUTICAL ENGINEERING

(COURSE 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 130 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 114.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3	–	3	–
Analytical Geometry	503	2	–	2	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	271	1	–	1	–
Electricity	330	2	–	2	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	2	–	2	–
Physical Education	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	3	4	3	4
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aeronautics	1	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	274	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	2	–	–	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	2	–	2	–
Engineering Problems and Drawing	291	–	3	–	3
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Education	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	3	–	–	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Mechanics	27	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	2	3	1	3
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Electrical Engineering	375, 376	2	3	2	3
Heat Engines, Theory	420, 421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	3	2	3
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Propulsion	11	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Gas Dynamics	30	2	–	2	–
Modern Political and Economic Trends	325	–	–	$1\frac{1}{2}$	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy	549	1	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderantly engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Calculus 491, page 113.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course (see Practical Experience, 698, page 123).

First Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	-	2	-
Dynamics	21, 275	1	1	2	1
Electricity	330	2	-	2	-
Engineering Problems and Drawing	275	-	6	-	6
English	610	2	-	2	-
Mechanical and Thermal Measurements	448	1	-	1	-
Physical Education	640	-	2	-	2
Practical Experience	698	-	-	-	-
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	-	-

Second Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Circuits	367, 368	-	-	2	1½
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	-	2	-
Dynamics	22	-	-	2	-
Economics	311	2	-	3	-
Electricity	338, 334	2	3	-	-
Engineering Chemistry	226	2	-	-	-
Engineering Problems and Drawing	288	-	6	-	6
Heat Engines, Elementary	420	-	-	2	-
Industrial Chemistry	233	1	-	1	-
Mechanics of Materials	23, 31	2	3	2	-
Physical Metallurgy	532	2	-	-	-
Physical Education	640	-	2	-	2
Practical Experience	698	-	-	-	-

Third Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	–	2	–
Applied Economics	308	2	–	2	2
Differential Equations	507	1	–	1	–
Electronics	345, 346	2	1½	–	–
Elementary Structural Engineering	29, 298	1	6	1	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	2	1	1	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	2	–	–	–
Political Science	323	–	–	2	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

Fourth Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Business Policy	309	3	2	3	2
Electric Machines	342, 343	2	3	–	–
Engineering Law	314	1	–	–	–
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Illumination and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	–	–	1½	–
Philosophy of Science	326	2	–	–	–
Physical Metallurgy II	547, 548	1	–	1	1½
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	–	2	3
Thesis	740	–	2	–	2

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 33.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, II Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text book: Technical Aerodynamics—K. D. Wood.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Two dimensional airfoil theory; finite wing theory; performance calculation; drag and boundary layers; static stability and control.

Text books: Airfoil and Airscrew Theory—Glauert. Airplane Performance, Stability and Control—Perkins & Hage. Foundations of Aerodynamics—Kuethe & Schetzer.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

Half of the time allotted is spent in the drafting room working problems on airfoil theory, performance, stability, and control. The other half is spent in the wind-tunnel laboratory, where experiments are conducted to illustrate the principles of fluid mechanics, and to demonstrate typical aerodynamic data.

Text book: Wind Tunnel Testing—Pope.

5. Airplane Design and Layout. T. R. Loudon, W. Czerwinski, R. D. Hiscocks, D. G. Allan.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

The preliminary design of light aircraft is discussed in these lectures. It is intended to give the student a grasp of the principles of balance and load distribution necessary for the design of the various components. About three quarters of these lectures are given in a class room, the remainder being given in the laboratory where practical work is carried out.

Text books: Civil Airworthiness Requirements (I.C.A.O.). Civil Aeronautics Manual 04 (U.S.).

6. Airplane Design and Layout Laboratory. T. R. Loudon, W. Czerwinski, D. G. Allan.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

This course is divided roughly into three periods devoted respectively to the preliminary design of light aircraft, fitting design and layout and final design of a light aircraft project which is actually constructed under the supervision of skilled aircraft mechanics. The course gives the practical application of the lectures in course 5.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Analysis and Design of Airplane Structures—Bruhn. Aircraft Structures—Peery. Airplane Structures—Niles and Newell.

8 Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 3 hrs. laboratory per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. Some of this work is taken in conjunction with light aircraft design in laboratory work described in subject 6.

9. Airplane Stress Analysis. D. G. Allan.

Course 10, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

These lectures serve as an introductory course to the advanced structural analysis course used in aircraft design given in the fourth year. An introductory course is also given on the methods used in determining the balance of an aircraft for the various cases laid down by I.C.A.O. and other governing bodies.

Text books: Analysis and Design of Airplane Structures—Bruhn. Fundamentals of Aircraft Structures—Barton. I.C.A.O.—Airworthiness Manual. A.R.B.—Manual (Section D). C.A.M.—04 (U.S.).

10. Airplane Stress Analysis Laboratory. D. G. Allan.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aircraft Propulsion. R. B. McIntyre.

Course 10, IV Year; 1 hr. lecture per week, both terms.

This course of lectures deals with theory of the propeller. The principles of operation of the reciprocating engine, turbo jet, gas turbine and rocket are explained.

12. Aircraft Layout. W. Jackson, R. D. Hiscocks.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 3, 7, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures.

Text book: Applied Statics—Loudon.

21. Dynamics. M. W. Huggins.

Courses 1, 3, 7, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith, F. C. Hooper, J. M. F. Vickers.

Courses 1 and 7, II Year; 1 hr. lecture per week, both terms.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Reference book: Mechanics—Part II—Meriam.

Text book: Engineering Dynamics—Hooper and Smith.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins and staff in Civil Engineering.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

For Course 10, the work is carried further in order to cover some more advanced problems dealing with plate girders.

Text book: Resistance of Materials—Seely.

24. Applied Mechanics. B. Etkin, D. G. Allan.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts; statics in the fall term; and dynamics in the spring term.

Statics: Principles of plane statics and application to a variety of problems including elementary framed structures and simple beams.

Dynamics: Principles of dynamics, and application to plane motion of particles, and plane translation of rigid bodies.

Text books: Applied Statics—Loudon. Vectorial Mechanics—Brand.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 2 hrs. lectures per week, first term.

Introduction to vector analysis; vector treatment of kinematics; Coriolis' acceleration; general plane motion of rigid bodies; gyroscopes; dimensional analysis.

Text book: Vectorial Mechanics—Brand.

26. Applied Mechanics. B. Etkin, D. G. Allan.

Courses 2, 6, 8 and 9, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts; statics in the fall term, and dynamics in the spring term.

Statics. Principles of plane statics and application to a variety of problems including elementary framed structures and simple beams.

Dynamics. Principles of dynamics, and application to motion of particles on straight and curved paths—work, energy, power, impulse and momentum. Plane translation of rigid bodies.

Text books: Applied Statics—Loudon. Principles of Physics, Mechanics—Sears.

27. Advanced Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Continuation of course 25, dealing with rotating frames of reference; Euler's Equations for rigid bodies; oscillating systems of one and more degrees of freedom; Lagrange's Equations.

Text books: Vectorial Mechanics—Brand. Principles of Mechanics—Synge & Griffith.

28. Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young and Morrison. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. C. F. Morrison, M. W. Huggins.
Courses 2, 3, and 11, III Year; 1 hr. lecture per week, both terms.
Practically the same work as that for subject 28 in the first term.

30. Gas Dynamics. G. N. Patterson.
Course 10, IV Year; 2 hrs. lectures per week, both terms.
An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods. Some instruction will be given at the Institute of Aerophysics.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.
Courses 1, 2, 5, 9, and 10, II Year; 3 hrs. laboratory per week, second term.
Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.
An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.
Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.
Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.
A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.
Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.
Course 10, III Year; 1 hr. lecture per week, both terms.
Vector operators; classical equations for perfect fluids; velocity potential; stream function; complex potential; Bernoulli's equation for incompressible and compressible flow. Vorticity, circulation, lift. Poiseuille flow.
Text book: Fluid Dynamics—Streeter. Airfoil and Airscrew Theory—Glauert.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Courses 1 and 2, III year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool. Elementary Structural Engineering—Urquhart and O'Rourke.

Reference Book: Basic Reinforced Concrete Design—Lange.

36. Theory of Structures. C. F. Morrison.

Course 1a, IV Year; 2 hrs. lectures per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

37. Theory of Structures and Reinforced Concrete. Staff in Civil Engineering.

Course 1a, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out in the laboratory following the lecture courses 36 and 41.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1a, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

40. Soil Mechanics and Foundations. T. R. Loudon, W. L. Sagar.

Course 1a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

The design of foundations, retaining walls and dams is discussed in detail preliminary to working out problems in the laboratory.

Reference books: Foundation of Structures—Dunham. Soil Mechanics in Engineering Practice—Terzaghi and Peck. Soil Mechanics, Foundations, and Earth Structures—Tschebotarioff.

Proceedings, Second International Conference on Soil Mechanics.
Design of Concrete Structure—Urquhart and O'Rourke.

41. Reinforced Concrete. M. W. Huggins.

Course 1a, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the rigid arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Text book: Basic Reinforced Concrete Design—Large.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

43. Structural Design. M. W. Huggins.

Course 1a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Steel Mill Buildings—Ketchum. Structural Problems—Young and Morrison. Theory of Modern Steel Structures—Grinter.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 3 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Course 3, IV Year; 2 hrs. lectures per week, first term.

Courses 1b and 11, IV Year; 2 hrs. lectures per week, both terms.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson. Structural Problems—Young and Morrison.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1a, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Specifications—Dept. of Highways, Ontario. A.S.T.M.; C.S.A.; A.A.S.H.O. Specifications. Soil Testing for Engineers—Lambe.

APPLIED PHYSICS

70. Applied Physics. F. B. Friend, J. R. Bird, P. A. Macpherson.

Courses 1, 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics—Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. F. B. Friend, J. R. Bird, P. A. Macpherson.

Courses 1, 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

72. Optics. K. B. Jackson.

Course 8, II Year; 1 hr. lecture per week, both terms.

Light, geometrical and physical optics and optical instruments pertaining to chemical and metallurgical engineering.

73. Optics Laboratory.

Course 8, II Year; 3 hrs. laboratory per week, both terms.

A laboratory course supplementing subject 72.

75. Photogrammetry. K. B. Jackson.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

77. Photogrammetry. K. B. Jackson.

Course 1_b, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Photographic optics, photographic materials and processes, photography applied to measurement. Terrestrial and aerial survey photography. Perspective, scale, tip and tilt, rectification. Planimetric mapping. Stereoscopy. Stereoscopic photographs and plotting instruments. Topographic mapping. Photo interpretation. The application of aerial photographs to mapping, to the survey of natural resources, and to planning and development.

78. Photogrammetry. K. B. Jackson.
Course 1_b, IV Year; 3 hrs. laboratory per week, both terms.
Supplementing subject 77.

82. Acoustics. V. L. Henderson.
Course 7, IV Year; 2 hrs. lectures per week, second term.
This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.
Reference book: Elements of Acoustical Engineering—Olson.

83. Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Supplementing course 82.

89. Architectural Acoustics. V. L. Henderson.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.
Reference book: Acoustical Designing in Architecture—Knudsen and Harris.

90. Architectural Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 89.

91. Illumination and Acoustics. V L. Henderson, J. R. Bird.
Course 11, IV Year; 1 hr. lecture per week, both terms.
The production of light and the engineering principles underlying its utilization.
The generation and control of sound.
Reference book: Less Noise Better Hearing—Sabine.

92. Illumination and Acoustics. V. L. Henderson, J. R. Bird, P. A. Macpherson.
Course 11, IV Year; $1\frac{1}{2}$ hrs. laboratory per week, both terms.
A laboratory course supplementing course 91.

93. Illumination. J. R. Bird.
Course 7, IV Year; 2 hrs. lecture per week, second term.
Illuminating Engineering dealing with the nature, measurement, and production of light and related radiations.
Theory of human vision; the design and application of lighting equipment for visual efficiency and comfort. Fundamentals of power supply.

94. Illumination Laboratory. J. R. Bird.
Course 7, IV Year; 3 hrs. per week, second term.
Supplementing subject 93.

95. Photometry and Illumination Design. J. R. Bird.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. J. R. Bird.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

Acoustics of electrical sound systems; including sound waves hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference book: Elements of Acoustical Engineering—Olson.

98. Acoustics Laboratory. V. L. Henderson, P. A. Macpherson.

Course 5e, IV Year; 1½ hrs. laboratory per week, first term.

Supplementing subject 97.

99. Vibration Engineering. V. L. Henderson.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson, P. A. Macpherson.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ASSAYING, MINING AND ORE DRESSING

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved. but also upon the errors inherent in operators as well as in methods,

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich. The Sampling and Assay of the Precious Metals—E. A. Smith.

161. Assaying Laboratory. M. Hewer.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

The determination of precious metals. Scorification, crucible and combination wet and dry methods of assaying ores both simple and

complex; milling and metallurgical products including cyanide solutions, cyanide precipitates and gold bullion. Attention is also given to the sampling and assay of ores containing radio-active minerals.

162. Wet Analysis. M. Hewer.

Course 2, III Year; 3 hrs. laboratory per week, both terms.

Analysis of furnace products, base metal and radioactive ores.

165. Mining. The Staff in Mining Engineering.

Courses 2 and 9, I Year; 2 hrs. per week, second term.

A combined laboratory and lecture course. It is an introduction to the principles of mining and sampling calculations.

166. Mining. H. R. Rice.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

A course of lectures relating to underground and surface mining methods, rock boring machinery and practice.

168. Mining.

Courses 2 and 9, III Year; 2 hrs. lectures per week, first term.

Methods of mine development by mine adits, shafts, drifts and crosscuts; stoping methods, loading, and underground transportation.

169. Mining Laboratory. S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, first term; 2 hrs. laboratory per week, second term.

Special mining problems are given relating to sampling, diamond drilling, stope measurements, the factors affecting the angle of repose of broken materials and the behaviour of such materials when in motion. To develop the individual students' initiative, some special survey problems are worked in the laboratory.

170. Mine Operation and Management. H. R. Rice.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, both terms.

Lectures on advanced mining practice, deep mining problems, mine mechanization, underground crushing, hoisting and communications, mine safety and hygiene, mine plant and layout, mining company structure and financing, cost statements, incentive wage plans, and various aspects of labor relations such as labor legislation, unions and collective bargaining.

172. Mining Laboratory. H. R. Rice.

Courses 2 and 9, IV Year; 2 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Problems in mine layout involving shaft location and size; mine development; choice of stoping methods, mining rate, and mine equipment; time and cost schedules; ore reserve calculations.

175. Mine Ventilation and Allied Problems. G. R. Lord.

Course 2, IV Year; 2 hrs. lectures per week, first term.

Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

176. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.

Course 2, IV Year; 3 hrs. laboratory per week, first term.

Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

180. Mineral Dressing. S. E. Wolfe.

Courses 2, and 8, III Year; 2 hrs. lectures per week, both terms.

The course deals with the economics of, the theoretical principles and their practical application in, the treatment of ores and mineral aggregates. These involve the processes of crushing, grinding, sizing and classification; gravity, magnetic, and electrostatic separation; and an introduction to froth flotation. In addition, ancillary processes are studied. These include flocculation, sedimentation, filtration, drying of mineral products and the precipitation and collection of dust and fume.

182. Mineral Dressing Laboratory. S. E. Wolfe.

Course 2, III Year; Course 8, IV Year; 6 hrs. laboratory per week, second term.

This work is coordinated with the lecture course 180. Studies are made of crushing machinery, the principles of crushing and grading of rock products, screen analysis, and the sampling of broken material and mill products. Certain tests with gravity concentrating machines are made and an introduction to the technique of flotation test work is given.

183. Ore Dressing. S. E. Wolfe.

Course 2 and 8, IV Year; 1 hr. lecture per week, both terms.

The subjects covered are extensions of those in 180 and 182; cyanidation, flotation processes and technique, the current practice at milling plants, and problems associated with milling.

184. Ore Dressing Laboratory. S. E. Wolfe.

Course 2, IV Year; 6 continuous hours per week, first term.

Advanced work coordinated with lecture course 183 and pertaining to ore dressing appliances, the handling in bulk of finely divided solids, the selective flotation of sulphides, ore testing, and pilot plant mill runs.

186. Mineral Dressing. S. E. Wolfe.

Course 9, III Year; 2 hrs. lectures per week, first term.

This abridged course deals with current practice and fundamental principles in the field of mineral beneficiation.

190. Theory of Measurements. M. Hewer.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

Engineering work requires the practical utilization of measurements which have varying degrees of precision. This course deals

with the philosophy underlying the causes of errors, their effect and relative importance upon computed results, and the interpretation of numbers to represent measurements. The use of charts and graphs to illustrate certain measurements and the derivation of empirical equations from these charts is also considered.

192. Summer Essay. M. Hewer.

Course 2, III Year:

An essay, or report, written on a mining subject, preferably some phase of work with which the student is associated during summer employment. Subsequently, each student will deliver a talk to his class on the subject chosen. Thus, training is afforded in both technical writing and public speaking. Students are briefed in advance concerning requirements of this course.

193. Oral Expression. Mrs. Helen Tucker.

Courses 2 and 9, II Year; 2 hrs. seminar per week, second term.

A seminar course in oral expression. The objective is to improve the ability to speak as a means of communication. Clear expression of sound thinking is discussed and practised in speech assignments.

ASTRONOMY AND GEODESY

200. Practical Astronomy. H. L. Macklin.

Course 1, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

The derivation of formulae and their application to the solution of spherical triangles and practical problems. Practical determination of time, latitude and azimuth by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Text books: Nautical Almanac for current year and printed lecture notes.

201. Control Surveys and Mapping. O. J. Marshall.

Course 1, III Year; 1 hr. lecture per week, second term.

Principles and Methods of control surveys involving triangulation, traverse, and levelling of various degrees of precision; elementary geodesy and map projections.

Text book: Advanced Surveying and Mapping—Whitmore.

Reference books: Higher Surveying—Breed and Hosmer, Vol. II, 6th Ed. Theory and Practice Surveying—Tracy.

202. Astronomy. O. J. Marshall.

Course 1_b, IV Year; 1 hr. lecture per week, first term.

Precise determination of time, latitude, longitude and azimuth as applied to geodetic surveys.

203. Astronomy. O. J. Marshall.

Course 1_b, IV Year; 3 hrs. laboratory per week, first term.

Observations and problems to accompany subject 202.

204. Geodesy. O. J. Marshall.

Course 1_b, IV Year; 2 hrs. lectures per week, second term.

Geometry of the spheroid, geographic co-ordinates, common map projections with related co-ordinate systems.

205. Geodesy. O. J. Marshall.

Course 1_b, IV Year; 3 hrs. laboratory per week, second term.

Problems in geodetic computations.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, W. M. Walkinshaw.

Course 1, IV Year; 3 hrs. per week, both terms.

Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration and Contracts. A. E. Berry, W. M. Walkinshaw.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 299.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, also forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

217. Transportation Engineering.

Course 1a, IV Year; 1 hr. lecture per week, both terms.

Highway: Organization, administration, economics and planning, paving materials, the principles governing location, design and construction of highways and airports.

Reference books: The Highway Improvement Act—Ontario. Highway Standards and Specifications—Department of Highways of Ontario. Highway Design and Construction—Bruce. Highway Engineering—Ritter and Paquette.

218. Town and Regional Planning. A. P. C. Adamson, J. Tyrwhitt.

Course 1_b, IV Year; 2 hrs. lectures per week, first term.

Principles of town planning in relation to residential areas, industrial zones, business and recreation centres, road traffic and parking. General survey of the Ontario Planning Act and its operation.

Text books: Town Planning—Thomas Sharp. Concerning Town Planning — LeCorbusier. City Development — Lewis Mimford. Town Planning & Road Traffic—Alkar Tripp. The Ontario Planning Act.

219. Town and Regional Planning. A. P. C. Adamson, J. Tyrwhitt.
Course 1_b, IV Year; 3 hrs. laboratory per week, first term.
Preparation of an official plan, zoning by-law and site plan for a residential area. Preparation of an outline plan and report on the means by which a long term and short term plan for a wider area can be implemented within the framework on Ontario Legislation.
Text books: The Ontario Planning Act. How to Subdivide—H. Spence Sales. Community Planning Review, Housing Design Supplement No. 1.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. The Staff in Chemical Engineering.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.
Chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. W. F. Graydon.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, I Year; 3 hrs. laboratory per week, both terms.
A laboratory course illustrating the fundamental laws of chemistry as dealt with in the lecture course, and providing an introduction to chemical analytical methods.

224. Chemistry. J. G. Breckenridge.
Courses 2 and 9, II Year; 2 hrs. lectures per week, first term.
An introduction to modern theories of molecular structure, and to organic chemistry.

226. Engineering Chemistry. The Staff in Chemical Engineering.
Courses 1, 3, 7, and 11, II Year; 2 hrs. lectures per week, first term.
Water-treatment, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. W. F. Graydon.
Courses 2 and 9, II Year; 6 hrs. laboratory per week, first term.
Volumetric and gravimetric analysis.

228. Analytical Chemistry Laboratory. F. E. Beamish.
Course 8, II Year; 4 hrs. laboratory per week, both terms.
Quantitative and qualitative analysis.

229. Analytical Chemistry Laboratory. W. F. Graydon
Course 6, II Year.
This course commences on the Wednesday following the first Monday in September, and continues until the opening of the Fall Term. All the working time will be spent on systematic quantitative inorganic analysis.
Text book: Textbook of Inorganic Analysis—Kolthoff and Sandell.

230. Industrial Chemistry. W. G. MacElhinney.

Course 6, II Year; 3 hrs. lectures per week, first term: 3 hrs. laboratory per week, second term.

Manufacture of acids, alkalis, and inorganic chemicals; water-treatment, corrosion, explosives. The second term work consists of calculations dealing with certain industrial chemical problems.

231. Inorganic Chemistry. C. P. Brockett.

Courses 6 and 8, II Year; 2 hrs. lectures per week, first term: 1 hr. lecture per week, second term.

The constitution of matter and classification of the elements: systematic inorganic chemistry.

In preparation for this course, students will be expected to have read and to be familiar with the following: Mellor's Modern Inorganic Chemistry (1951 Edition), Chapters 8-9, 17–25, 35.

232. Chemical Laboratory. W. F. Graydon, P. M. Corbett, C. P. Brockett.

Course 6, II Year; 2 hrs. lectures and 9 hrs. laboratory per week, first term; 9 hrs. laboratory per week, second term.

A continuation of Subject 229, followed by methods of technical analysis, and instruction in glass-blowing and shop practice.

233. Industrial Chemistry. P. M. Corbett.

Course 11, II Year; 1 hr. lecture per week, both terms.

Manufacture of acids, alkalis, inorganic chemicals.

234. Organic Chemistry. J. G. Breckenridge.

Course 6, II Year; 3 hrs. lectures per week, second term.

An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

236. Physical Chemistry. R. L. McIntosh.

Courses 6 and 8, II Year; 2 hrs. lectures per week, both terms.

Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

Text book: Principles of Phase Equilibria—Wetmore and LeRoy

240. Chemical Theory. R. R. McLaughlin, W. F. Graydon.

Course 6, III Year; 3 hrs. lectures per week, both terms.

A discussion of the principles of adsorption and colloid chemistry; chemical thermodynamics and kinetics.

241. Industrial Chemistry. W. G. MacElhinney, W. H. Rapson.

Course 6, III Year; 3 hrs. lectures per week, second term.

Chemical process industries, including petroleum, soap, sugar, pulp and paper, and fermentation industries. In preparation for

this course, students will be expected to have read and to be thoroughly familiar with the following: Chemical Process Industries—Shreve: Chapters 29, 30, 31, 33, 34, 37.

242. Chemical Engineering. W. G. MacElhinney.

Course 6, III Year; 2 hrs. lectures per week, both terms: 3 hrs. laboratory per week, second term.

The theory and practice of heat transfer, evaporation, filtration, and other unit operations. The laboratory work in the first term consists of calculations on chemical engineering problems. In preparation for this course, students will be expected to have read and to be thoroughly familiar with recommended chapters from the following text: Unit Operations—Brown.

244. Organic Chemistry. J. G. Breckenridge.

Course 6, III Year; 2 hrs. lectures per week, both terms.

A continuation of subject 234, dealing mainly with aromatic compounds.

245. Organic Chemistry Laboratory. W. H. Rapson.

Course 6, III Year; 9 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

A laboratory course accompanying subject 244.

246. Electrochemistry. F. E. W. Wetmore.

Courses 6 and 8, III Year; 2 hrs. lectures per week, first term.

Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.

Courses 6 and 8, III Year; 18 hrs., first term.

Quantitative measurements to accompany subject 246.

249. Chemical Laboratory. W. F. Graydon.

Course 6, III Year; 6 hrs. laboratory per week, both terms.

A laboratory course to accompany Subject 240.

250. Organic Chemistry. J. G. Breckenridge.

Course 5, II Year; 2 hrs. lectures per week, first term.

General reactions and methods of synthesis of carbon compounds.

Text book: Organic Chemistry. A Brief Course—Brewster.

251. Chemical Laboratory. A. I. Johnson, P. H. Calderbank, P.M. Corbett, W. G. MacElhinney.

Course 6, IV Year; 12 hrs. laboratory per week, first term.

A continuation of subject 243, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, organic, and analytical chemistry.

253. Chemical Engineering. A. I. Johnson.
Course 6, IV Year; 2 hrs. lectures and 2 hrs. laboratory per week, both terms.
A continuation of subject 242; the laboratory periods consist of calculations on selected chemical engineering problems and instruction in the use of graphical methods.

256. Chemical Engineering Thermodynamics and Kinetics. P. H. Calderbank.
Course 6. IV Year; 2 hrs. lectures per week, both terms.
The application of thermodynamics and kinetics to problems in the field of chemical engineering.

257. Organic Chemistry. R. R. McLaughlin.
Course 6, IV Year; 1 hr. lecture per week, both terms.
The chemistry of natural and synthetic high-molecular-weight materials.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

269. Descriptive Geometry. A. Wardell.
Courses 1, 2, 6, 8 and 9, I Year; 1 hr. lecture per week, both terms.
These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines and planes.
Text book: Descriptive Geometry—Watts and Rule.

270. Descriptive Geometry. A. Wardell.
Courses 3, 7 and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
These lectures deal with the principles of orthographic and oblique projection and their use in solving problems of straight lines, planes and curved surfaces. Problems of shades, shadows and perspective are also dealt with.
Text book: Descriptive Geometry—Watts and Rule.

271. Descriptive Geometry. A. Wardell.
Courses 5 and 10, I Year; 1 hr. lecture per week, both terms.
Course 269 with the addition of some work in curved surfaces.
Text book: Descriptive Geometry—Watts and Rule.

272. Descriptive Geometry. A. Wardell.
Course 1, II Year; 1 hr. lecture per week, both terms.
A continuation of lecture course 269. Problems of curved surfaces, shades, shadows and perspective are discussed: also, an introduction is given to the principles of projection used in map making.
Text book: Descriptive Geometry—Watts and Rule.

274. Descriptive Geometry. A. Wardell.

Course 10, II Year; 1 hr. lecture per week, both terms.

A continuation of lecture course 271. Problems of curved surfaces, shades, shadows and perspective are discussed with attention to problems of special interest to students in aeronautical engineering.

Text book: Descriptive Geometry—Watts and Rule.

ENGINEERING PROBLEMS AND DRAWING

The courses in Engineering Problems and Drawing consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems in the First and Second Years deal with the fundamental engineering studies—mathematics, applied mechanics, descriptive geometry, the plotting of surveys that have been made by the student in the field, theory of machines, while in the Third and Fourth Years, the problems deal mainly with design.

275. Engineering Problems and Drawing. A. Wardell.

Courses 1, 3, 7 and 11, I year; 11 hrs. per week, both terms.

Courses 2 and 9, I year; 6 hrs. per week, first term; 7 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus.) Plotting or original surveys.

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

279. Engineering Problems and Drawing. A. Wardell.

Course 5, I Year; 3 hrs. per week, both terms.

Course 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Plotting of original surveys.

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

280. Engineering Problems and Drawing. A. Wardell.

Course 6, I Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Course 8, I Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. The solving of problems in descriptive geometry, applied mechanics, and mathematics.

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

284. Engineering Problems and Drawing. A. Wardell.

Course 1, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials. Problems in mathematics (calculus).

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

285. Engineering Problems and Drawing. A. Wardell.

Course 2, II Year; 6 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheets. Plotting of original surveys

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

286. Engineering Problems and Drawing. A. Wardell.

Course 3, II Year; 6 hrs. per week, both terms.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of machines. Problems in mathematics (calculus).

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

287. Engineering Problems and Drawing. A. Wardell.

Course 6, II Year; 3 hrs. per week, alternate weeks, both terms

Problems in mathematics.

Textbook; Engineering Drawing—French, 7th Edition.

288. Engineering Problems and Drawing. A. Wardell.

Course 7, II Year; 9 hrs. per week, first term; 6 hrs. per week, second term.

Course 11, II Year; 6 hrs. per week both terms.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials. Problems in mathematics (calculus).

Textbook: Engineering Drawing—French-Vierck, 8th Edition.

289. Engineering Problems and Drawing. A. Wardell.

Course 8, II Year; 3 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials and mathematics.

Text book: Engineering Drawing—French-Vierck, 8th Edition.

290. Engineering Problems and Drawing. A. Wardell.

Course 9, II Year; 3 hrs. per week, both terms.

Problems in descriptive geometry and mechanics of materials.

Text book: Engineering Drawing—French-Vierck, 8th Edition.

291. Engineering Problems and Drawing. A. Wardell.

Course 10, II Year; 3 hrs. per week, both terms.

Problems in descriptive geometry— intersection of curved surfaces. Problems in mechanics of materials.

Text book: Engineering Drawing—French-Vierck, 8th Edition.

297. Engineering Problems and Drawing. W. B. Dunbar.

Course 1, III Year; 9 hrs. per week, both terms.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses.

298. Engineering Problems and Drawing. W. B. Dunbar.

Course 2, III Year; 3 hrs. per week, second term.

Course 3, III Year; 3 hrs. per week, both terms.

Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar.

Course 1a, IV Year; 3 hrs. per week, both terms.

Problems based on lecture course 43.

300. Structural Design Drawing. W. B. Dunbar.

Course 3, IV Year; 3 hrs. per week, first term.

Courses 1_b and 11, IV Year; 3 hrs. per week, second term.

Problems in determination of stresses in, and design of mill building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. F. N. Beard.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

Basic accounting principles and procedures, the preparation and interpretation of financial statements, cost accounting, and the use of accounting as a means of control.

307. Statistics. D. C. MacGregor.

Course 11, III Year; 2 hrs. lectures per week, both terms.

An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. S. Stykolt.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

A survey of contemporary economic institutions and problems and the application of economic theory to income determination, money and banking, industrial fluctuations, fiscal policy and labour problems.

309. Business Policy. A. W. Currie, G. F. Bain.

Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.

Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.

Courses 1, 2, 3, 7, and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. S. Triantis.

All courses, II Year; 2 hrs. lectures per week, both terms.

An Introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An introduction to Political Economy—Bladen.

313. Engineering Economics.

Courses 1, 2, 7, 8 and 9, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. W. O. Chris. Miller.

Courses 1, 3, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, construction contracts, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management.

Course 8, IV Year, 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of management, including labour relations, plant organizing, maintenance and safety.

318. Industrial Management. E. A. Allcut.

Courses 1, 3, 6 and 7, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.

Course 6, III Year; Course 6, IV Year; 1 hr. per week, both terms.

321. Industrial Management A. E. A. Allcut, K. C. Livingston.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, first term; 1 hr. lecture and 1 hr. laboratory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

323. Introduction to Political Science. M. P. O'Connell.

All courses, III Year; 2 hrs. lectures per week, second term.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. H. I. Nelson.

All courses, III Year; 2 hrs. lectures per week, first term.

An outline of the chief trends and developments in selected key areas during the 19th and 20th centuries.

325. Modern Political and Economic Trends. C. F. Owen.

All courses, IV Year; 18 lectures, second term

A study of the theory and practice of modern economic and political trends.

326. Philosophy of Science. Marcus Long.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, IV Year; 2 hrs. lectures per week, first term.

The relation between Science and Philosophy; an examination of the presuppositions of science and its basic concepts; alternative accounts of the nature of the universe with their implications for social and moral behaviour.

327. The Profession of Engineering. G. R. Lord.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering.

328. Industrial Management B. T. C. Graham, J. C. Sawatzky.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service, etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. Staff in Electrical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference book: Introduction to Electrical Engineering—Ward.

332. Electricity. H. A. Courtice, G. F. Tracy.

Course 7, II Year; 2 hrs. lectures per week, both terms.

General principles and calculations of electric circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacitance, power, and energy. In the second term, a study of alternating-current circuits is commenced, including characteristics of sinusoidal waves, series circuits, complex algebra, parallel circuits, power and power factor, all with reference to the single-phase circuit.

Reference books: Basic Electrical Measurements—Stout. Alternating-Current Circuits—Kerchner and Corcoran. Alternating-Current Circuits—Tang.

333. Electrical Fundamentals. J. E. Reid.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

Reference book: Electric and Magnetic Fields—Boast.

334. Electrical Laboratory.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

335. Electrical Problems.

Course 7, III Year; 2 hrs. per week, first term; 4 hrs. per week, second term.

Problems associated with subjects 336, 337, 339, 341 are assigned and worked out under staff supervision. As practice in public speaking, one hour per week in the second term is used for short talks by students on subjects of their own choosing. Comments and suggestions are made by staff members in charge.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, both terms.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair.

Course 7, III Year; 2 hrs. lectures per week, both terms; 3 hrs. laboratory per week, alternate weeks, second term.

The behaviour of electrons in electric and magnetic fields and the application of electronics to electrical engineering.

Reference book: Electronic Engineering Principles—Ryder.

338. Electricity. H. A. Courtice.

Courses 3 and 11, II Year; 2 hrs. lectures per week, first term.

General principles and calculations of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Basic Electrical Measurements—Stout.

339. Direct Current Machines. C. E. Doeringer.

Course 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering. Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of

Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

341. Alternating-Current Circuits. G. F. Tracy.

Course 7, III Year; 2 hrs. lectures per week, both terms.

A continuation of the study of alternating-current circuits begun in 332 Electricity, second year. Polyphase circuits, non-sinusoidal waves, coupled circuits, the transformer. Measurements in A-C circuits.

Reference books: Alternating-Current Circuits—Kerchner and Corcoran. Alternating-Current Circuits—Tang.

342. Electrical Machines. C. E. Doeringer.

Course 11, IV Year; 2 hrs. lectures per week, first term.

Operating characteristics and applications of direct-current and alternating-current machines.

343. Electric Machines Laboratory.

Course 11, IV Year; 3 hrs. laboratory per week, first term.

Laboratory exercises to accompany Subject 342.

344. Electrical Laboratory.

Course 7, III Year; 3 hrs. laboratory per week, both terms.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Electronics. G. F. Tracy and Staff.

Courses 3 and 11, III Year; 2 hrs. lectures per week, first term.

Thermionic emission, vacuum-tube characteristics and applications, amplifiers, gaseous-tube characteristics and applications.

Text book: Basic Electrical Engineering—Fitzgerald.

346. Electronics Laboratory.

Courses 3 and 11, III Year; 3 hrs. laboratory alternate weeks, first term.

Laboratory exercise to accompany subject 345.

347. Electric Circuits and Machines. G. F. Tracy and Staff.

Courses 1, 2 and 9, II Year; 1 hr. lecture per week, both terms.

Principles of alternating-current circuits, impedances in series and parallel, three-phase circuits. Power measurement in single-phase and polyphase circuits. The transformer and the induction motor.

348. Electrical Laboratory.

Courses 1, 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Introductory laboratory practice in methods of measuring electrical quantities. Experiments on alternating-current circuits, the transformer and the polyphase induction motor.

351. Circuit Analysis. V. G. Smith.

Course 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.

Course 5e, IV Year; 2 hrs. lectures per week, both terms.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid, G. Sinclair, L. S. Lauchland.

Courses 5e and 7, IV Year; 3 hrs. lectures per week, first term.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are analyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. G. F. Tracy.

Course 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Electric Circuits. L. S. Lauchland.

Course 5, II Year; Course 8, III Year; 2 hrs. lectures per week, both terms.

Principles of direct-current circuits including the more important methods of measuring resistance, potential difference, current, power and energy. Principles of alternating-current circuits together with methods of calculating single-phase and polyphase circuits, network theorems.

355. Electrical Laboratory.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week, second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electric Circuits Laboratory.

Course 5, II Year; Course 8, III Year; 3 hrs. laboratory alternate weeks, both terms.

Laboratory exercises to accompany subject 354.

357. Engineering Electronics. J. M. Ham.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, first term 1 hr. lectures per week, second term.

Electronic devices, such as the thyratron, ignition and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.

Course 7, IV Year; 2 hrs. per week, both terms.

Oral presentation by each fourth year student of his thesis, together with discussions by other members of the group.

360. Communications I. J. E. Reid, G. Sinclair.

Courses 5e, 5i, 5s, 5m and 7, IV Year; 3 hrs. laboratory per week, first term.

The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.

Reference book: Electron-Tube Circuits—Seely.

361. Communications Laboratory.

Courses 5e, 5i, 5s, 5m and 7, IV Year; 2 hrs. lectures per week, both first term.

Experiments and problems to accompany subject 360.

362. Communications II. J. E. Reid, G. Sinclair.

Courses 5e and 7, IV Year; 3 hrs. lectures per week, second term.

A continuation of subject 360.

363. Communications Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory per week, second term.

Experiments and problems to accompany subject 362.

364. Operational Methods. V. G. Smith.

Courses 5e, 5i, 5m, and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Circuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus—Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5e, 5g, 5m and 5s, IV Year; 2 hrs. lectures per week, both terms.

A comparison of the classical, the rationalized C.G.S. and the M.K.S. systems of units is made, thereafter the M.K.S. rationalized system is used exclusively. Electrostatics is developed to the point where it is used to compute the capacities of engineering structures. Magnetostatics is mentioned briefly. The laws of electromagnetism are reviewed and Maxwell's equations developed. These are applied in a study of the reflection and refraction of plane waves, in an elementary study of rectangular wave guides and of the radiation from an antenna.

Reference books: Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague. Fundamentals of Electric Waves—Skilling. Wave Guides—Lamont.

366. Electronics. V. G. Smith.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Basic theory of the behaviour of electrons in electric and magnetic fields, thermionic emission, vacuum-tube characteristics and applications, conduction through gases, gaseous-tube characteristics and applications.

Reference books: Applied Electronics—M.I.T. Staff.

367. Alternating-Current Circuits. G. F. Tracy and Staff.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Methods of treating alternating-current circuits, root-mean-square values, series circuits containing resistance, inductance and capacitance, parallel circuits, three-phase circuits.

368. Alternating-Current Circuit Laboratory.

Courses 3 and 11, II Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 367.

369. Alternating Current Machinery II. G. F. Tracy.

Course 7, IV Year; 2 hrs. lectures per week, second term.

A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.

Courses 5e and 7, IV Year; 2 hrs. lectures per week, second term.

Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory.

Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Laboratory exercises and problems to accompany subject 371.

373. Electric Power Systems. L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures and 2 hrs. computation per week, second term.

General considerations of generation, transmission, and distribution; steady-state performance of systems, metering, fault calculations, fusing, relaying, lightning phenomena.

375. Electrical Engineering. A. J. Kravetz.

Courses 6 and 8, II Year; 2 hrs. lectures per week, both terms.

Course 10, III Year; 2 hrs. lectures per week, both terms.

Principles of d-c and a-c circuits including the more important methods of measuring resistance, current, potential difference, power and energy; the principles of operation of d-c and a-c machinery; thermionic tube characteristics and applications.

376. Electrical Engineering Laboratory.

Courses 6 and 8, II Year; 3 hrs. laboratory per week, both terms.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Laboratory exercises to accompany subject 375.

377. Electric Machines. G. F. Tracy.

Courses 3 and 5e, III Year; Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Operating characteristics, control, and applications of direct-current and alternating-current machines.

378. Electric Machines Laboratory.

Course 3, III Year; 3 hrs. laboratory alternate weeks, first term: 3 hrs. laboratory per week, second term.

Course 5e, III Year; Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

Laboratory exercises to accompany subject 377.

379. Electronics Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, second term.

Laboratory exercises to accompany subject 366.

GEOLOGICAL SCIENCES

380. Physical Geology. P. A. Peach.

Courses 2 and 9, I Year; 2 hrs. lecture per week, both terms.

An introduction to the study of geology and mineralogy.

Reference Books: Principles of Physical Geology—Holmes. Outlines of Historical Geology—Schuchert and Dunbar.

381. Physical Geology Laboratory. C. V. Phipps.

Courses 2 and 9, I Year; 2 hrs. per week, second term.

A laboratory course to accompany subject 380. Local field trips.

382. Engineering Geology. W. H. Gross.

Courses 1 and 5g, III Year; 2 hr. lecture per week, both terms.

Structural, dynamic and economic geology, with special reference to engineering problems.

383. Engineering Geology Laboratory. C. V. Phipps.

Courses 1 and 5g, III Year; 1 hr. per week, first term; 2 hrs. per week, second term.

Specimens, maps, and sections to accompany subject 382.

384. Glacial Geology. R. E. Deane.

Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.

Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.

385. Elementary Geochemistry. F. G. Smith.

Course 9, III Year; 2 hrs. lectures per week, both terms.

Covering the periodic table, distribution of the elements, states of matter, phase diagrams, natural hydrothermal solutions, weathering, and geochemical cycles.

386. Mineralogy and Lithology. D. H. Gorman, P. A. Peach.

Courses 2, and 9, II Year; Course 8a, III Year; Course 5g, IV Year; 2 hrs. lecture per week, both terms.

A study of crystallography, descriptive and determinative mineralogy, and the common rocks.

Reference book: An Introduction to the Study of Minerals—Rogers.

387. Mineralogy and Lithology Laboratory. D. H. Gorman, P. A. Peach.
Courses 2, and 9, II Year; Course 5g, IV Year; 2 hrs. per week, both terms.
Practice in identifying minerals and rocks.

388. Descriptive Mineralogy. D. H. Gorman.
Course 9, III Year; Course 9, IV Year (1954–55 only); 2 hrs. laboratory per week, both terms.
Continuation of the mineralogy of subject 386.

389. Ore Microscopy. D. H. Gorman.
Course 9, III Year; 3 hrs. laboratory per week, second term.
Identification of minerals in polished sections.

390. Morphological Crystallography. E. W. Nuffield.
Course 8, III Year; Courses 5m and 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

391. Petrology. P. A. Peach.
Course 9, III Year; 3 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.
Microscopic character of the rock-forming minerals in thin sections, and description and classification of rocks.
Text book: Optical Mineralogy—Rogers and Kerr.

392. Petrography Laboratory. P. A. Peach.
Course 9, III Year; 2 hrs. per week, both terms.
Microscopic petrography, to accompany subject 391.
Text books: As in subject 391.

393. Historical and Stratigraphical Geology. F. W. Beales.
Course 9, II Year; 2 hrs. lectures per week, both terms.
Study of the principles of stratigraphy and historical geology since Precambrian times.

394. Historical and Stratigraphical Geology Laboratory. F. W. Beales.
Course 9, II Year; 2 hrs. per week, both terms.
Laboratory work to illustrate subject 393.

395. Palaeontology. M. A. Fritz.
Course 9, III Year; 2 hrs. lectures per week, both terms.

396. Palaeontology Laboratory. M. A. Fritz.
Course 9, III Year; 2 hrs. per week, both terms.

397. Structural Geology. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Structures caused by the deformation of the earth's crust.
Text book: Structural Geology—Billings.

398. Structural Geology Laboratory. W. M. Tovell.
Courses 2 and 9, III Year; Course 5g, IV Year; 3 hrs. per week, both terms.

Work with geological maps of folded and faulted areas, structural sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 397.

399. Mineral Deposits. W. H. Gross.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
The first term covers the metallic ore deposits and the second term the non-metallic deposits, including coal and petroleum.

400. Mineral Deposits Laboratory. W. H. Gross.
Course 9, III Year; 3 hrs. per week, both terms.

401. Geology of Canada. F. W. Beales.
Course 9, IV Year; 1 hr. lecture per week, both terms.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

403. Precambrian Geology. W. W. Moorhouse.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Precambrian formations of Canada—their rocks, distribution, relationships and economic features.

404. Precambrian Geology Laboratory. W. W. Moorhouse.
Course 9, IV Year; 2 hrs. laboratory per week, both terms.
To accompany subject 403.

405. Mining Geology. G. B. Langford.
Courses 2, 5g and 9, IV Year; 2 hrs. lectures per week, second term.
A course dealing with the application of geology to mining.
Reference book: Mining Geology—McKinstry.

406. Mining Geology Laboratory. G. B. Langford.
Course 9, IV Year; 3 hrs. per week, both terms.
A laboratory course to accompany subject 405.

407. Petroleum Geology. W. M. Tovell.
Course 9, IV Year; 2 hrs. lectures per week, both terms.
The origin, nature, and occurrence of petroleum and natural gas deposits and the extraction of these substances from the earth.

408. Petroleum Geology Laboratory. W. M. Tovell.
Course 9, IV Year; 3 hrs. per week, second term.
Accompanying subject 407.

409. Geological Field Work.
Courses 2 and 9, III Year; given at the University Survey Camp preceding the opening of the first term. Students taking this course must supply themselves with a geological pick, hand lens, and engineer's 6″ pocket scale.
Reference book: Field Geology—Lahee.

410. Geological Field Trips (Historical Geology).
Course 9, II Year (1 day).
The Niagara Escarpment and the west end of Lake Ontario.

411. Geological Field Trips (Precambrian and Mineralogy).
Course 9, III Year. $2\frac{1}{2}$ days.
Bancroft and Madoc Areas.

412. Geological Field Trips (Glacial Geology).
Courses 2 and 9, IV Year. Three $\frac{1}{2}$ day trips.
During October weekly trips will be made to points of interest near Toronto.

413. Geological Field Trips (Petroleum).
Course 9, IV Year. $2\frac{1}{2}$ days.
Oil and gas fields in Chatham area.

414. Geological Field Trips (Economic and Mining).
Course 9, IV Year. Two trips, each $\frac{1}{2}$ day.
Trip to gypsum mine and cement plant.

HEAT ENGINES

420. Elementary Heat Engines. F. G. Ewens, P. B. Hughes.
Course 3, II Year; 2 hrs. lectures per week, second term.
Course 11, II Year; 2 hrs. lectures per week, second term.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
Course 7, II Year; 1 hr. lecture per week, first term.
Course 10, III Year; a reading course.
The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.
Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut, F. C. Hooper.
Course 3, III Year; 2 hrs. lectures per week, both terms.
Courses 7 and 10, III Year; 2 hrs. lectures per week, both terms.
Course 11, III Year, 2 hrs. lectures per week, both terms.
For each group selected topics are arranged to suit the courses included in the group.
The application of the laws of thermodynamics to ideal processes and cycles using gases and vapours. The cycles used in practice for steam and internal combustion engines, compressors and refrigerating plants. Unavailable energy and entropy. Theoretical and practical efficiencies obtainable. Heat transfer and regeneration. Tables and charts for vapours used in engineering practice.
Reference book: Elementary Engineering Thermodynamics—Young and Young.

422. Heat Engineering. R. C. Wiren, W. A. Wallace, F. C. Hooper.
Courses 3 and 5t, III Year; 2 hrs. lectures per week, both terms.
Steam Turbines. Types and basic characteristics; condensers and auxiliaries.

Text book: Steam Power Plants—Potter.

Steam Generators and Plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design of boilers, furnaces, stokers, pulverised fuel equipment, economizers, air heaters, superheaters, etc.

Text book: Steam Power Plants—Potter.

Internal Combustion Engines. Types and operation; performance and testing; basic characteristics and principles of design; carburation; fuel injection; governing.

Text book: Internal Combustion Engines—Obert.

Heat Transfer and Air Conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Reference books: Internal Combustion Engines—Polson. Maleev. Fraas. Steam Turbines—Church. Steam Power Plants—Gaffert. MacNaughton. Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Courses 3, 5t, and 10, III Year; 1 three-hour laboratory period per week, both terms.

Course 7, III Year; 1 three-hour laboratory period per week, first term.

Courses 6 and 11, III Year; 1 three-hour laboratory period per week, second term.

The laboratory work is designed to assist in clearer understanding of theory and practical applications, and consists of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

The work on Heat Engines deals with the setting of slide valves, measuring indicated and brake horse-power, the use of power plant instruments and auxiliaries, testing of air compressors, steam engines, steam turbines and internal combustion engines under various conditions, steam calorimetry and the solution of numerous practical problems on steam plants, internal combustion engines, and gas turbines.

The Fuel Testing includes analysis of fuels and products of combustion, knock rating of gasolines, fuel calorimetry, etc.

The work on Heat Transfer deals with temperature measurement, tests on insulation and heat exchangers of various kinds.

The work on air conditioning deals with the use of instruments and charts, air conditioning standards, the solution of practical problems, and testing of air conditioning equipment.

424. Heat Power Engineering. R. C. Wiren.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

A continuation of lecture course 421 consisting of a more advanced study as applied to power plants. Properties of pure substances. Analysis and applications of the First and Second Laws. Change of phase and equations of state. Thermodynamic functions and relations as applied to a perfect gas and working fluids used in power plants. Steam as a working fluid. Steam turbines. Power plant cycles including reciprocating engines and turbines. Cycles for high pressures and temperatures. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies. Design of power plant equipment.

Reference books: Heat and Thermodynamics—Zemansky. Engineering Thermodynamics—Obert. Young. Sears. Everett. Keenan. Ebaugh. Hawkins. Steam Power Plants—Gaffert. Potter. MacNaughton. Steam Turbines—Church. Salisbury.

425. Internal Combustion. E. A. Allcut.

Courses 3 and 5t, IV Year; 1 hr. lecture per week, both terms.

The various types of internal combustion engine and their respective applications. The different cycles of operation and the avoidable and unavoidable losses. The admission, compression, combustion, expansion and exhaust operations, the factors that influence them and their application to the engine and turbine. The cooling system and its effect on thermal and mechanical conditions.

426. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Course 3, IV Year; 5 hrs. laboratory work per week, both terms.

Course 5t, IV Year; 6 hrs. laboratory work per week, both terms.

A continuation and extension of the work covered in the III Year laboratory subjects consisting of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

In the Heat Engine laboratory complete tests are made of various engines such as simple, compound and uniflow steam engines, impulse and reaction type steam turbines, steam injectors, gas, oil and gasoline engines. In each case an analysis is made of the thermal cycle involved, a complete set of experiments is performed and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. An analysis is made of cycles used in gas turbines and jets. Problems involving variable specific heat are studied.

In the Fuel Testing laboratory the octane rating of gasoline samples is determined by A.S.T.M. methods and fuel injection spray characteristics are studied with special test equipment.

In the Heat Transfer laboratory tests are made on heat exchangers.

In the Air Conditioning and Refrigeration laboratory tests are performed on complete air conditioning systems, and complete refrigerating plants.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 2, III Year; Course 2, IV Year (1954–55*v*only); 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to engines, nozzles, turbines, compressors, heat transfer devices, refrigeration plants, and air conditioning systems. Analysis of vapour and gas power cycles.

Text book: Basic Thermodynamics—Brown.

Reference books: Engineering Thermodynamics—Young, Ebaugh.

Theory and Practice of Heat Engines—Faires.

428. Heat Engine Laboratory. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper, J. M. F. Vickers.

Course 1, III Year; 2 hrs. laboratory per week, second term.

Course 2, III Year; $1\frac{1}{2}$ hrs. per week, first term. Course 2, IV Year; $1\frac{1}{2}$ hrs. per week, first term (1954–55*v*only).

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course 5t, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

430. Heat Power Engineering. R. C. Wiren.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Application of Thermodynamics to the design of power plant equipment. Analysis of high pressure and high temperature vapour cycles. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies.

Reference books: Steam Power Plants—Gaffert. Potter. Mac-

Naughton. Steam Turbines—Church, Salisbury. Engineering Thermodynamics—Obert, Young, Keenan, Hawkins.

431. Theory of Heat Engines. P. B. Hughes.

Course 6, III Year; 2 hrs. lectures per week, first term.

The theory and practice of heat engines, including a study of fundamental principles involved, an appraisal of theoretical developments, and a survey of the corresponding practical applications.

Text book: Theory and Practice of Heat Engines—Faires.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2, III Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes and open channels, with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, D. G. Huber, M. J. Kenn.

Courses 1, 3 and 11, III Year; one 3-hr. laboratory period per week, second term.

Course 2, III Year; six 3-hr. laboratory periods, first term.

Course 7, III Year; one 3-hr. laboratory per week; first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. The lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc. are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3- and 2-hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomena, fans and ductwork, and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps. Turbines and water power developments.

446. Hydraulic Laboratory. G. R. Lord, D. G. Huber.

Course 1, IV Year; one 3-hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

448. Mechanical and Thermal Measurements. L. E. Jones.

Courses 2, 3, 7, 9, and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities and means of measuring them. Dimensions, units, standards. Length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 3 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analyzing technical data; elements of curve-fitting and statistical treatment.

450. Hydraulics. D. G. Huber.

Course 5t, III Year; 1 hr. lecture per week, both terms.

A course emphasizing the fundamentals of fluid flow in pipes with special reference to refrigeration problems and including discussion of pumps.

Reference books: Elementary Fluid Mechanics—Vennard. Centrifugal Pumps and Blowers—Church. Refrigerating Data Book.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Fluid Mechanics. L. E. Jones.

Course 6, IV Year; 2 hrs. lectures per week, first term.

The fundamentals of fluid flow as generally encountered in industry. Fluid properties, fluid statics, energy relations, dimensional analysis and dynamic similarity, flow in pipes and channels, resistance of submerged bodies, effects of viscosity and compressibility, lubrication, pumps and other hydraulic machines.

453. Fluid Mechanics Laboratory. G. R. Lord, L. E. Jones.

Course 6, IV Year; 3 hrs. laboratory per week, first term.

A course of laboratory experiments and design problems to permit of correlating flow fundamentals with industrial applications.

MACHINERY

461. Mechanical Engineering. W. G. McIntosh.

Course 3, II Year; 2 hrs. lectures per week, both terms.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

462. Elementary Machine Design. R. T. Waines.

Course 7, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machin-

ing, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Manufacturing Equipment and Processes—Lytle and Gould.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design (involving material applications and calculation of stresses) and selection of various machine elements with particular application to power transmission (belting, shafting and gearing), fastening screws, power screws and wire rope.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory will illustrate the lecture subject.

465. Theory of Machines. I. W. Smith.

Course 3, II Year; 3 hrs. lectures per week, both terms.

Course 10, II Year; 3 hrs. lectures per week, first term.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical application. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams, including inertia effects. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating and reciprocating parts.

Text book: Mechanism—Prageman.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Spotts.

468. Machine Design Laboratories. W. G. McIntosh, I. W. Smith R. T. Waines, S. V. Hayes.

Course 3, III Year; 6 hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.
Course 10, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, both terms.

Design laboratory work will be taken by students in all courses listed above. This will involve the design of machine elements with the object of illustrating the work covered in the lecture subjects in Machine Design. Sketching and drafting will be given with a view to developing the student's judgment and sense of proportion in design and the application of drafting room standards.

Mechanics of Machinery laboratory work will be taken by Course 3 only. This will include the analytical and graphical solution of problems dealing with inertia loads and stresses and the determination of speed fluctuation.

Mechanical laboratory work will be taken by Courses 3 and 10. This will include selected experiments in speed measurement, oil testing, balancing, vibrations, testing of power drives, etc.

Machine and Welding Shops laboratory work will be taken by all groups. This will take the form of demonstrations of equipment in these shops with a view to assisting students in the visualization of manufacturing methods employed for parts being designed.

469. Machine Design. R. T. Waines.

Courses 2 and 8, IV Year; 1 hr. lecture per week, both terms.

The design and selection of machinery and equipment met with in metallurgical plants, and in mining work.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6 and 8, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. S. V. Hayes.

Course 5, III Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Spotts.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, S. V. Hayes.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

This is a continuation of Subjects 467 and 466. It will involve the design of various machine elements and equipment including machine frames, hooks, hoisting equipment, crankshafts, gears (helical, herringbone, bevel, screw, and worm), springs, clutches, brakes, thin and thick wall vessels.

An introduction will be given to the study of vibration problems encountered in high speed engines and machines.

Text book: Design of Machine Elements—Spotts.

474. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Advanced laboratory work involves both analysis and design of machine elements, machine units, and complete machines. The selection of problems is made with a view to giving the student as broad a coverage as possible and providing experience in combining of elements to form a machine of smooth and harmonious design. Some of this work will involve special shafting problems including graphical solutions, critical speeds, and multiple supports.

Work will be given in the Mechanical Laboratory on gauging and fine measurements, experimental stress analysis, vibration, and bearing testing.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Spotts.

476. Manufacturing Processes. K. C. Livingston.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

First term work deals with the steel industry. Processes considered are those involved in iron and steel production, casting, machining, welding and heat treatment.

Processes by which textiles, glass, paper and rubber are manufactured are discussed during the second term.

Text book: Manufacturing Processes—Begeman.

477. Manufacturing Processes Laboratory. K. C. Livingston.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Problems based upon the topic treated in subject No. 476 will be given during the first term.

The class during the second term will be concerned with the process and management problems of some industries.

478. Machine Design. I. W. Smith.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

A series of lectures intended to supplement subject 471 of the Third Year, while co-ordinating with the Fourth Year thermodynamic subjects, by presenting the overall approach employed in the design of simple power units.

479. Machine Design. R. T. Waines.

Course 6, IV Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical plants, and an outline of the properties, production methods, and selection of materials used in machine equipment.

Text book: Introduction to Mechanical Design—Jefferson and Brooking.

480. Mechanical Engineering Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, S. V. Hayes.

Course 3, II Year; 3 hrs. laboratory per week, both terms.

Problems will be given in mechanical engineering, including velocity, acceleration, and force analyses; speed fluctuation; cam layout; gearing; and balancing.

MATHEMATICS

490. Calculus. I. R. Pounder, G. F. D. Duff, J. A. Jacobs, J. T. Jenkins, W. A. Skirrow, A. W. Walker.

Courses 1, 2, 3, 6, 7, 8, 9, and 11, I Year; 2 hrs. lectures per week, both terms.

Derivation of the fundamental formulas of the differential and integral calculus, with applications to problems concerning curves, areas, volumes, lengths. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283.

491. Calculus. J. D. Burk, W. O. J. Moser, A. Robinson, D. A. F. Robinson, W. T. Tutte.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Continuation of subject 490. The elementary theory reviewed and extended, with special attention to applications in engineering. Introduction to simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288 and 289.

492. Analytical Geometry. I. R. Pounder, G. F. D. Duff, J. A. Jacobs, J. T. Jenkins, W. A. Skirrow, A. W. Walker.

Courses 1, 2, 3, 6, 7, 8, 9, and 11, I Year; 1 hr. lecture per week first term: 2 hrs. lectures per week second term.

The Analytical Geometry covers the more familiar propositions dealing with the straight line, circle, parabola, ellipse, and hyper-

bola. Introduction to Analytical Geometry of Three Dimensions. In addition, problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282 and 283.

494. Least Squares. O. J. Marshall, H. L. Macklin.

Course 1, II Year; 3 hrs. laboratory per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulæ.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes.

495. Mathematical Problems. W. J. Webber, D. A. F. Robinson, W. T. Tutte, A. H. Lightstone, G. Zyskind.

Courses 5 and 10, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. W. J. R. Crosby.

Courses 5 and 10, I Year; 3 hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books: Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. R. G. Stanton.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and conics, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special

functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. W. T. Tutte.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Mrs. C. C. Krieger-Dunaj, D. A. S. Fraser, W. J. Moser, E. E. Noonan, A. Robinson.

Courses 1, 3, 6, 8, and 11, III Year; 1 hr. lecture per week, both terms.

First order equations solvable by quadratures, linear equations of first and second orders, linear equations with constant coefficients of higher order.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Mrs. C. C. Krieger-Dunaj.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorf, and Pohlhausen. Introduction to Complex Variables and Applications—Churchill.

509. Differential Equations. Mrs. C. C. Krieger-Dunaj.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. J. A. Steketee.
Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.
A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.
Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. Robinson, J. A. Steketee.
Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.
The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.
Text books: Fourier series and Boundary Value Problems—Churchill. Modern Operational Mathematics in Engineering—Churchill. Partial Differential Equations of Mathematical Physics—Webster.

523. Adjustment of Observations. O. J. Marshall.
Courses 1_b, IV Year; 3 hrs. per week, second term.
Problems illustrating the application of Least Squares to the adjustment of observed data, with particular reference to surveying measurements.

METALLURGY

530. Metallurgy. L. M. Pidgeon, W. C. Winegard.
Course 8, II Year; 1 hr. lecture per week, both terms.
Courses 2 and 9, III Year; 1 hr. lecture per week, first term.
An introductory course describing the theory and practice of metallurgical operations, and principles of physical metallurgy.

531. Metallurgical Problems Laboratory. H. U. Ross, G. Michaud.
Course 8, III Year; 2 hrs. laboratory per week, both terms.
Problems in physical chemistry and thermodynamics as applied to metallurgical reactions.

532. Physical Metallurgy I. W. C. Winegard, R. S. Davis.
Course 11, II Year; Course 3, III Year; 2 hrs. lectures per week, first term.
A general course in Physical Metallurgy, dealing with the structure of metals and alloys, with special reference to the ferrous and non-ferrous alloys of practical importance. The influence of mechanical deformation, heat treatment and composition on the structure is considered, and the relation between the structure and the mechanical properties is examined.

533. Metallurgical Theory. A. Bethune.
Course 8, III Year; 2 hrs. lectures per week, both terms.
The physico-chemical principles of metallurgy.

534. Principles of Extractive Metallurgy. L. M. Pidgeon.
Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A general discussion of the fundamental principles of extractive metallurgy with reference to the production of the more important metals.

535. Principles of Extractive Metallurgy Laboratory. H. U. Ross.
Course 8, III Year; 3 hrs. laboratory per week, first term.
Experiments in pyrometry, roasting, smelting, leaching, retorting and refining designed to illustrate the principles underlying these operations. Spectrographic analysis of metals is included.

536. Principles of Physical Metallurgy. W. C. Winegard.
Courses 5m and 8, III Year; 2 hrs. lectures per week, both terms.
One hour lecture per week in first term consists of a series of lectures on the structure of solids, with particular reference to x-ray methods of investigation.

537. Physical Metallurgy Laboratory. W. C. Winegard.
Courses 5m and 8, III Year; 3 hrs. laboratory per week, both terms.
Practical work relating to subject 536.

538. Metallurgy. L. M. Pidgeon.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes.

539. Metallurgy Laboratory. H. U. Ross.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgical Problems Laboratory. H. U. Ross, W. C. Winegard.
Course 8, IV Year; 2 hrs. laboratory per week, both terms.
Problems dealing with subject matter in subjects 542, 543 and 552.

541. Metallurgy Laboratory. H. U. Ross, G. Hutton.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term.
A continuation of subject 535.

542. Non-Ferrous Production Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Extractive metallurgy of the non-ferrous metals, including electrometallurgy.

543. Physical Metallurgy. W. C. Winegard.
Courses 5m and 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536.

544. Physical Metallurgy Laboratory. W. C. Winegard.
Courses 5m and 8, IV Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practical work relating to subject 543.

546. Physical Metallurgy. W. C. Winegard, K. V. Gow.
Course 1, III Year; 2 hrs. lectures per week, first term.
A short course on the influence of heat and mechanical treatment on the structure and properties of steels and the more important non-ferrous alloy.

547. Physical Metallurgy 2. W. C. Winegard, R. S. Davis.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 532.

548. Physical Metallurgy Laboratory. W. C. Winegard.
Courses 3 and 11, IV Year, 1½ hrs. laboratory per week, second term.
A practical course illustrating the principles dealt with in subjects 532 and 547.

549. Physical Metallurgy. W. C. Winegard, J. W. Rutter.
Courses 5e, 5s, 5i, 5g, 5t and 7, III Year; Courses 2 and 10, IV Year; 1 hr. lecture per week, both terms.
A short course in Physical Metallurgy; structure of metals and alloys; effects of mechanical distortion and heat treatment on structure; relation between structure and mechanical properties; and properties of some steels and non-ferrous alloys.

550. Metallurgical Theory. The Staff in Metallurgical Engineering.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

552. Ferrous Production Metallurgy. H. U. Ross, C. E. Elbaum.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Production metallurgy of iron and steel.

MODERN LANGUAGES

610. English.
Courses 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11, I Year; 2 hrs. lectures per week, both terms.
(a) Literature: Shakespeare, *Antony and Cleopatra* (Ginn); Milton, *Samson Agonistes* (Crofts); Shaw, *The Devil's Disciple* (Penguin);

Fielding, *Tom Jones* (Modern Library), Hardy, *Tess of the D'Urbervilles* (Macmillan); Mitchell, *Who Has Seen the Wind* (Macmillan); Williams (ed.), *Palgrave's the Golden Treasury* (Mentor); Evans & Lawson (eds.) *Contemporary Verse* (Longmans); Mill, *On Liberty* (Crofts); Arnold, *Four Essays* (Crofts). Final examination on these texts.

(*b*) Composition: Study of textbook to be selected by instructor; writing of original compositions: final examination in practical composition.

PHYSICAL EDUCATION

640. Physical Education.
All courses, I and II Years.

PHYSICS

650. Properties of Matter; Mechanics and Heat. G. D. Scott.
Courses 5 and 10, I Year; 3 hrs. lectures per week, both terms.
Text books: Physics, Vol. 1—Shortley and Williams. Principles of Physics, Vol. 1—Sears. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. G. D. Scott, Miss K. M. Crossley.
Courses 5, and 10, I Year; 3 hrs. laboratory per week, both terms: 1 hr. tutorial per week, both terms.
Supplementary to subject 650.

652. Elementary Magnetism and Electricity. R. W. McKay.
Courses 5 and 10, II Year; 2 hrs. lectures per week, both terms.
Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.
Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.
Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.
Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.
Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

655. Physics Laboratory (Magnetism and Electricity and Light).
Course 5, II Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Course 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652 and 653.

656. Physics of Solids and Fluids. C. Barnes.

Course 5, III Year; 1 hr. lecture per week, both terms.

Gravitational potential and Laplace's equation. Vibration theory –damped motion, coupled oscillations, etc. Elasticity. Introduction to fluid motion and heat conduction. Differential equations of quantum mechanics.

657. Thermodynamics and Kinetic Theory. D. G. Ivey.

Course 5, III Year; 3 hrs. lectures per week, both terms.

Temperature scales, thermometry, calorimetry. First and Second laws, Entropy and Kelvin Thermodynamic Scale, equations of state, the Virial expansion. Ideal and van der Waal's gases. Specific heats. Thermodynamic functions. Joule-Thomson effect. Radiation and pyrometry up to Wien and Planck Laws. Distribution of velocities. Transport Phenomena. Brownian motion.

659. Physical Laboratory. D. G. Ivey.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term. Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, W. H. Watson, H. L. Welsh.

Courses 5e, 5i, 5g, 5m, 5s, and 5t, IV Year; 3 hrs. lectures per week, both terms.

Introduction to quantum theory, atomic, molecular and nuclear physics.

665. Physical Laboratory. H. J. C. Ireton.

Course 5s, IV Year; 9 hrs. laboratory per week, both terms.

Course 5m, IV Year; 6 hrs. laboratory per week, both terms.

Accompanying the lecture subjects 663, 666, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 2 hrs. lectures per week, both terms.

Diffraction, interference, and polarisation.

Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams. Cours d'Optique—Bruhat.

669. Analysis of Materials by Spectrographic and X-Ray Methods. H. J. C. Ireton.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. P. N. S. O'Brien.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, thermometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. P. N. S. O'Brien.

Course 9, IV Year; 1 hr. lecture per week, both terms.

Introduction to physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, thermometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. P. N. S. O'Brien.

Course 5g, IV Year; 6 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 670.

673. Geophysics. P. N. S. O'Brien.

Course 9, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.

Course 5i, IV Year; 3 hrs. laboratory per week, both terms.

Accompanying subject 663.

675. Physics of the Earth. J. T. Wilson, C. Barnes.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

676. General Physics. J. N. P. Hume.

Courses 6 and 8, I Year; 3 hrs. per week, both terms.

A first course in physics including an introduction to modern conceptions of matter.

677. Physics Laboratory. J. N. P. Hume.

Courses 6 and 8, I Year; 3 hrs. laboratory per week, both terms.

A course designed to accompany subject 676.

PRACTICAL EXPERIENCE

690. Practical Experience.

Course 1.

Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.

Course 2.

Every student in Mining Engineering is required to present before graduation satisfactory evidence of having had at least six months' practical experience of a nature acceptable to the department, in work connected with the Mineral Industry. Instruction regarding the type of work considered acceptable will be given by the department to the students during their first year. Certificate forms may be obtained from the department and the completed certificates should be returned to the department as soon as possible after the completion of each period of work.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

694. Practical Experience.

Course 6.

Every student in Chemical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 800 hours' experience in work connected with engineering practice of a nature acceptable to the department.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit before graduation, evidence of having had at least 1200 hours of practical engineering experience satisfactory to the department. Certificate forms may be obtained from the departmental office and the completed certificates should be returned to the department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Applied Geology is required to submit before graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development, underground work or service on geological field parties, and at least half of the time should be spent underground. Forms to be used in submitting experience record are available in the Department of Geological Sciences office.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such

experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. O. J. Marshall, H. L. Macklin, B. J. Haynes, J. R. Larke.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the tape, the transit, and the level, and computation of corrections, azimuths, bearings, latitudes and departures, co-ordinates and areas.

Text book: Surveying—Philip Kissam.

Reference books: Surveying—Philip Kissam. Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed.

712. Field Work. O. J. Marshall, H. L. Macklin, T. L. Rowe, B. J. Haynes, J. R. Larke, O. Lloyd, M. B. Wong.

Courses 1, 2, 3, 5, 7, 9, 10, and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; keeping of field notes; the use of the transit in surveying closed figures and traverse lines; plotting by co-ordinates; computing of areas; instrumental work with the level and calculating the volume of excavations.

714. Surveying. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, compound and spiral curves as applied to highway and railroad surveying. Main features of mine and hydrographic surveying.

Text books: Printed notes—Staff in Surveying. Route Surveys—Skelton.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term, 2 hrs. lecture per week, second term.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying. Practical determination of time, latitude and azimuth by methods adapted to the surveyor's transit.

Text books: Surveying—Breed and Hosmer. Introduction to Mine Surveying—Staley.

716. Field Work. O. J. Marshall, H. L. Macklin, B. J. Haynes, O. Lloyd.
Course 1, II Year; 3 hrs. per week, first term.
Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and curves.

717. Field Work. H. L. Macklin, B. J. Haynes.
Courses 2 and 9, II Year; 3 hrs. per week, first term; 2 hrs. per week, second term.
Adjustments of the transit and level, minor problems in triangulation and traversing, levelling, curves and topography.

718. Construction Surveying. O. Lloyd.
Course 1, III Year; 2 hrs. lectures per week, second term.
Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.
Earthwork:
(*a*) Cross sectioning.
(*b*) Computation of volume.
(*c*) Mass or haul diagram.
Transition and Vertical curves (including super-elevation).
Railway turnouts and sidings.
Layout of roads and sewers.

720. Survey Camp. O. J. Marshall, H. L. Macklin, B. J. Haynes, O. Lloyd, J. R. Larke, M. B. Wong, G. B. Langford, W. W. Moorhouse.
Courses 1, 2, and 9, III Year; Aug. 16 to Sept. 18—Gull Lake or Dorset.
Course 1:
(*a*) Secondary Triangulation and Base Line Measurements.
(*b*) Highway and Railway Location.
(*c*) Cross Sectioning and Computation of Earthwork.
(*d*) Stadia and Plane Table Topography.
(*e*) Observations for Time, Azimuth, and Latitude.
Courses 2 and 9:
(*a*) Stadia and Plane Table Topography.
(*b*) Mine Surveying, using overhead stations.
(*c*) Shaft plumbing and use of Auxiliary Telescope.
(*d*) Geological Surveying and mapping.
Students in Courses 1, 2, and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

721. Survey Camp. O. J. Marshall, B. J. Haynes.
Course 1_b, IV Year; Aug. 30 to Sept. 18 (3 weeks) Gull Lake.
Triangulation, traverses, levelling and astronomical observations by precise methods.

THESIS

730. Thesis.

Course 1, IV Year; 2 hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instructions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis Seminar.

Course 5, IV Year.

Each student in the Fourth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training for those fields.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the

Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, first term.

Each student must collect suites of rocks and minerals or fossils during the summer vacation preceding the IV Year. This material must be identified and described during the first term, and the report covering this work must be submitted by January 31st of the IV Year.

739. Thesis

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course 11, IV Year.

Each student in the Fourth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work in each subject is 50% and a student must obtain a weighted average of 60% in order to pass in the work of the year. He shall be required to pass a supplemental examination in each subject in which he obtains less than 50%. Subjects will be weighted according to the number of hours devoted to them, the hours assigned to laboratory subjects being given one half the weight of those in lecture subjects.

5. Honours and scholarships will be awarded upon the basis of the weighted average.

6. Honours will be awarded to a student, who at the Annual Examinations passes in all written and laboratory subjects and who also obtains a weighted average of 75% on the work of the year.

7. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

8. A student who fails in the work of any year, provided he is otherwise eligible, will be permitted to register provisionally for the purpose of repeating the year.

9. If the performance of a student repeating the First Year is unsatisfactory during the first term, as determined by laboratory marks and written examinations, he may be required to withdraw.

10. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

11. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they failed before presenting themselves a second time for examination.

12. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

13. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

14. A student who has failed to complete satisfactorily the course in Physical Education prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Education prescribed for the Second Year will not be permitted to register in the Fourth Year.

15. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 23rd day of August, 1954. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by the order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. MEDALS, PRIZES, SCHOLARSHIPS, BURSARIES AND FELLOWSHIPS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

In order to be eligible for a medal, prize, scholarship, bursary, fellowship or other awards granted solely upon standing obtained at an annual or special examination or upon an essay, or term work, or other academic rating, a candidate must obtain honours at such annual or special examination or upon such essay, term work, or other academic rating unless the statute respecting the award or medal specifies that standing lower than honours may be accepted.

When an award or medal is granted upon standing obtained on part of the work of any academic year the candidate must obtain standing but need not obtain honours in the work of the academic year as a whole, provided he obtains honours in the part concerned, unless the statute respecting the award or medal specifies otherwise.

No medal, prize, scholarship, bursary, fellowship or other award will be granted to a candidate who is conditioned in any subject at an annual examination or in Physical Education unless the statute respecting the award or medal specifies otherwise.

A candidate will not be permitted to receive more than one award in a session unless the statute establishing each of the awards concerned or the Calendar specifies otherwise. Only one of those marked by an asterisk may be held in any one year. A candidate who would, but for this provision, have received more than one award may have his name so published in the class lists.

A candidate who has spent two sessions in any year of an undergraduate course is not eligible to compete for any award at the annual examinations of that year.

Medals, after they have been suitably engraved, will be given without delay to the winners or forwarded to them by registered mail.

Awards granted to members of graduating classes other than awards for graduate study and research, will be paid in one instalment as soon as possible after the granting of the awards.

All other awards will be paid (i) if of the value of $50 or less, in one instalment on November 20 and (ii) if of the value of more than $50 in two equal instalments, the first on November 20 and the second on February 20, in the session following the granting of the awards provided that no payment is made to a candidate (*a*) who is not in regular attendance upon lectures and laboratory classes in the Faculty, or if the Calendar so specifies, in the course in which the award is established or granted (*b*) who does not present at the Chief Accountant's Office before each payment a certificate of attendance upon lecture and laboratory classes signed by two senior members of the staff.

The Senate may, on the recommendation of the Faculty, permit a candidate to whom an award has been granted to postpone attendance upon lectures and laboratory classes for one year. Further postponement may be permitted on application.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries.....	$2000	Yes	No	136
Class of 1937 Engineering Bursary.....................	$100	Yes	No	137
Hagarty Memorial Scholarship	$60	Yes	Yes	137
U.T.S. Engineering Scholarship	$250	Yes	Yes	137
The Leonard Foundation Scholarships..............	—	Yes	Yes	137
Simpson-Sears Limited (Northern Ontario) Scholarship.....................	$100	Yes	Yes	138
O.H.A. War Memorial Scholarship...............	$200	Yes	Yes	138
Engineering Alumni Admission Scholarship...............	$400	Yes	No	139
Students' Administrative Council Admission Scholarship...	$350	Yes	Yes	140
Wallberg Admission Scholarships (2).................	$1000	Yes	No	139
A.P.E.O. Admission Scholarship	$450	Yes	No	139
J. P. Bickell Foundation Scholarships (5)...........	$6000	Yes	Yes	140
Smith and Stone Limited Bursaries................	$150	Yes	Yes	141

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	141
*Baptie Scholarship..........	—	No	Yes	141
MacLennan-MacLeod Memorial Prize..............	$25	No	No	142
*Ransom Scholarship in Chemical Engineering............	$150	No	Yes	142
T. H. Bickle Prize...........	$30	No	Yes	142
Charles Gordon Manning Prize	—	No	No	143
*John M. Empey Scholarship..	$100	No	No	143
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics.......	$60	No	Yes	143
*Wallberg Undergraduate Scholarships (2)...........	$1000	No	No	144
*Hydro-Electric Power Commission Scholarship.......	$300	No	No	144
*Paulin Memorial Scholarship..	$300	No	Yes	144
*Association of Professional Engineers of the Prov. of Ontario Scholarships(3).....	$225	No	Yes	146
*Marsland Engineering Ltd. Scholarship	$500	No	Yes	147
University Naval Training Division Bursaries.........	$100	Yes	Yes	145
S. Ubukata Fund............	—	Yes	Yes	145
University of Toronto General Bursaries.................	—	Yes	No	161
Dominion-Provincial Student-Bursaries.................	—	Yes	No	161
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship..........	£400	Yes	No	154
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	141
*Harvey Aggett Memorial Scholarship...............	$75	No	No	146
J. A. Findlay Scholarship.....	—	No	Yes	146
*Association of Professional Engineers of the Province of Ontario Scholarships (3)....	$225	No	Yes	146

Name	Amount	Application required	Available only to a limited group or single course	See page
*Marsland Engineering Ltd. Scholarship	$500	No	Yes	147
T. H. Bickle Prize	$30	No	Yes	142
Hugh Gall Award	$100	Yes	No	145
Charles Gordon Manning Prize	—	No	No	143
Edith Tyrrell Memorial Bursary	$300	Yes	Yes	147
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships	—	No	Yes	148
*John M. Empey Scholarship	$100	No	No	143
W. G. Millar Memorial Scholarship	$250	Yes	Yes	149
*Wallberg Undergraduate Scholarships	$500	No	No	144
*Hydro-Electric Power Commission Scholarship	$300	No	No	144
Ardagh Prize	—	No	Yes	149
James L. Morris Memorial Prize	$60	No	Yes	149
University of Toronto General Bursaries	—	Yes	No	161
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	161
J. P. Bickell Foundation Bursaries	—	Yes	Yes	161
Scottish Rite Masons Bursary	$100	Yes	Yes	145
*Egerton S. Noble Scholarships (2)	$500	No	No	150
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship	£400	Yes	No	154
*Boiler Inspection and Insurance Company Scholarship	$150	No	Yes	150
University Alumni Federation War Memorial Scholarships	$250	Yes	No	141
*Jenkins Scholarship in Engineering	$200	No	No	151
Heating and Ventilating Engineers Prize	$75	No	No	151
E.I.C. Prize	$25	No	Yes	151
Engineering Society Semi-Centennial Award	$75	No	No	151

Name	Amount	Application required	Available only to a limited group or single course	See page
J. A. Findlay Scholarship.....	—	No	Yes	146
*Association of Professional Engineers of the Province of Ontario Scholarships (3).....	$225	No	Yes	146
*Marsland Engineering Ltd. Scholarship	$500	No	Yes	147
T. H. Bickle Prize...........	$30	No	Yes	142
Edith Tyrrell Memorial Bursary.................	$300	Yes	Yes	147
*California Standard Undergraduate Scholarships (2) ..	$750	No	Yes	148
Archie B. Crealock Memorial Prize....................	$50	No	Yes	151
*John M. Empey Scholarship..	$100	No	No	143
Hudson Bay Mining and Smelting Company Limited Scholarships.............	$800	Yes	Yes	152
*Wallberg Undergraduate Scholarships.............	$500	No	No	144
*Hydro-Electric Power Commission Scholarship.......	$300	No	No	144
Chemical Institute of Canada Prize....................	$25	No	Yes	152
*Kennecott Copper Corporation Scholarship..............	$1000	No	Yes	152
RCE Memorial Scholarship..	$125	Yes	Yes	153
*Charles H.Sage Scholarships(2)	$500	No	No	150
F. W. Baldwin Prize........	$25	No	Yes	150
J. A. D. McCurdy Prize.....	$25	No	Yes	150
University of Toronto General Bursaries................	—	Yes	No	161
Dominion-Provincial Student-Aid Bursaries............	—	Yes	No	161
J. P. Bickell Foundation Bursaries...............	—	Yes	Yes	161
Loan Funds...............	—	Yes	No	162
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR	—			
B.A.A.S. Medal		No	No	152

Name	Amount	Application required	Available only to a limited group or single course	See page
Heating and Ventilating Engineers Prize	$50	No	No	151
INCO. Scholarship	$500	Yes	Yes	153
"Second Mile Engineer" Award	$100	No	Yes	153
Henry G. Acres Medal	—	No	Yes	154
Massey-Harris-Ferguson Ltd. Scholarships (2)	$500	Yes	Yes	154
Ontario Section, American Society for Metals Prize	$50	No	Yes	153
University of Toronto General Bursaries	—	Yes	No	161
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	161
J. P. Bickell Foundation Bursaries	—	Yes	Yes	161
Loan Funds	—	Yes	No	162
AVAILABLE TO GRADUATES				
Rhodes Scholarship	£400	Yes	No	154
1851 Exhibition Science Research Scholarships	£275	Yes	Yes	155
McCharles Prize	$1000	No	No	156
Nipissing Mining Research Fellowships	$600	Yes	No	157
H. W. Price Research Fellowship in Electrical Engineering	—	Yes	Yes	157
C.I.L. Fellowship in Chemistry	$1200	Yes	Yes	157
T. A. Russell Memorial Research Fellowship	$1000	Yes	Yes	158
Consolidated Mining and Smelting Company Fellowship	$1000	Yes	No	158
Canadian Lumbermen's Association Timber Research Fellowship	$1000	Yes	No	158
Imperial Oil Graduate Research Fellowships	$4000	Yes	Yes	158
Wallberg Research Fellowships	$3000	Yes	No	159
Arthur Hays Sulzberger Fellowship	$1000	Yes	No	159

Name	Amount	Application required	Available only to a limited group or single course	See page
National Sewer Pipe Limited Scholarship	$500	Yes	Yes	159
Athlone Fellowships	—	Yes	No	159
1940 Toronto Fund	—	Yes	No	160
Raymond Priestley Fellowship	£450	Yes	No	160
Royal Institution of Great Britain Science Research Scholarships	£350	Yes	No	161

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

In those cases where the amount of the award is not payable from income earned on an endowed fund, payment will be dependent on the receipt of the amount of the annual award from the donor.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $200, will be awarded to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects of the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

CLASS OF 1937 ENGINEERING BURSARY

The class of 1937 presents annually a bursary of $100 to assist worthy engineering candidates to enter the Faculty. The award is based on the student's high school standing and on his need for financial assistance.

The recipient is selected from applicants for Applied Science Bursaries, and from candidates sponsored by Engineering Counsellors and by members of the Class of 1937.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE SIMPSON-SEARS LIMITED (NORTHERN ONTARIO) SCHOLARSHIPS

These scholarships, the gift of Simpson-Sears Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational Schcol, the Kapuskasing High School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage of the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute and Vocational School, from whom further information may be obtained regarding conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidate shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidate shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $400, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

WALLBERG ADMISSION SCHOLARSHIPS

Two admission scholarships, each of a value of $500.00 are awarded annually from the income from the Wallberg Bequest on the recommendation of the Council of the Faculty to the two candidates who obtain the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that this attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

Applications must be submitted to the Registrar on the prescribed form by May 1st.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO ADMISSION SCHOLARSHIP

The Association of Professional Engineers of the Province of Ontario has established an Admission Scholarship in Engineering of the value of $450.00, awarded for the Session 1953–54 at Queen's University and for

the Session 1954–55 at the University of Toronto and thereafter alternately at each University. It is awarded by the Senate on the recommendation of the Council of the Faculty of Applied Science and Engineering to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

Successive awards will be made in 1956 and every second year thereafter. Application must be made to the Registrar before May 1st.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities of North Bay, Sudbury, Sault Ste. Marie Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, in the School of Architecture, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent. at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

J. P. BICKELL FOUNDATION SCHOLARSHIPS

The Trustees of the J. P. Bickell Foundation have established in the Faculty of Arts and the Faculty of Applied Science and Engineering five scholarships for students entering First Year of a value of Twelve Hundred Dollars each.

Application must be made to the Registrar by May 1st and in order to be eligible the applicant must undertake to register in a course in Mining or Geology in the Faculty of Applied Science and Engineering, or in a course in Honour Science, or Mathematics, Physics and Chemistry in the

Faculty of Arts. If registering in the Faculty of Arts, the applicant must state his intention of proceeding in a course in Mining or Geology in future years.

Applicants must have obtained at the Grade XIII examinations standing satisfactory to the Committee of Award but need not obtain First Class Honours.

Each scholarship in tenable only in the First Year of the student's course. The first awards were made for the Session 1952–53.

SMITH AND STONE LIMITED BURSARIES

Smith and Stone Limited, Georgetown, Ontario, have provided five Bursaries, each of a possible value of $600 and each payable at the rate of $150 per year to assist deserving students from the Georgetown High School.

The award is made annually by the Senate on the recommendation of the Council of the Faculty to a student:

(*a*) who attended Georgetown High School for at least 2 years and is recommended by the Principal;

(*b*) who has met in full the admission requirements of the Faculty, first class honours not being a requirement.

To be eligible for continued enjoyment of the Bursary the holder must maintain satisfactory academic standing but not required to obtain honour standing.

The award was offered for the first time in the Session 1952–53.

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Five scholarships and awards, each of the value of $200.00 will be granted in 1954-55 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of financial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that a scholarship of one half the annual income shall be awarded annually to an engineering student on the record of the First Year.

The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. If in any year no award is made, a second award will be available in a subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time

of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

CHARLES GORDON MANNING PRIZE

The Charles Gordon Manning Prize was established by a bequest under the Will of the late Jennie Manning in the amount of Five Hundred Dollars ($500), the annual income from which is to be used to buy books for the winner of the Prize.

The recipient must be enrolled in the Second Year of a course offered by the Faculty of Applied Science and Engineering and, in the opinion of the Council, rank second to the student awarded the Harvey Aggett Memorial Scholarship in the considerations specified for the award of that Scholarship, namely, obtaining honours in his final examinations and being one of the first three in his year by his standing at those examinations relative to the pass requirements in his Department and being "adjudged highest of the three in general student activities and service in the University during his period of attendance."

The first award was made on the results of the Annual Examinations of 1954.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual

income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $500.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards listed in the Calendar with an asterisk. The awards were first made on the result of the annual examination of 1947.

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO SCHOLARSHIPS IN ENGINEERING

The Hydro-Electric Power Commission of Ontario has presented three scholarships in Engineering, each of a value of $300.00 to be awarded to three students selected from among the higher ranking students in the annual examinations of the First, Second, and Third Years in any course in the Faculty, one scholarship in each year to be tenable in the Second, Third and Fourth Years respectively.

The first award was made at the annual examinations in April, 1952.

Paulin Memorial Scholarship

The Paulin Memorial Scholarship, provided through the generosity of Mr. Fred W. Paulin, a graduate of the Faculty in 1907, was established in memory of his brother, John Cameron Paulin, a student in Mining Engineering, who was fatally injured in 1906 during a football practice. The Scholarship which has a value of $300.00, is awarded on the recommendation of the Department of Mining Engineering to a student registered in Mining Engineering, who has successfully completed the work of the First Year

The award is made on the following bases:

(*a*) academic proficiency.

(*b*) qualities necessary for the development of leadership, such as ambition, initiative, resourcefulness and strength of character.

(*c*) he must continue his studies in Mining Engineering during the following session.

The first award was made for the Session 1951-52.

HUGH GALL AWARD

The Hugh Gall Award, of the annual value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946 for a five year period and, through the generosity of Mrs. Hugh Gall extended for a further three year period. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions, has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session. A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

THE SCOTTISH RITE MASONS' BURSARY

The Scottish Rite Masons' Bursary, the gift of the Scottish Rite Masons of Toronto, of the value of $100. is awarded to a student enrolled in the Second Year who is a member of the Masonic Order, or a son, brother, nephew, daughter, sister or niece of a member of the Masonic Order. Consideration will be given to financial need and academic standing. Evidence of connection with the Masonic Order and information regarding financial need must be given with the application which must be submitted to the Secretary of the Faculty.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is

registered. An occasional student must obtain a certificate from the head of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available, each of a value of one half of the income of the fund, to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering:—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

MARSLAND ENGINEERING LIMITED SCHOLARSHIP

The Marsland Engineering Limited Scholarship, the gift of Marsland Engineering Limited, has a value of Five Hundred Dollars. It is awarded to the student who, having been granted a Dominion-Provincial Student Aid Bursary in his First Year, is registered in Mechanical or Electrical Engineering and obtains the highest average percentage of marks, with honours, at the annual examination of the First, Second or Third Years in the session in which the award is made.

The first award was made at the annual examinations of 1954.

EDITH TYRRELL MEMORIAL BURSARY

The Women's Association of the Mining Industry of Canada has presented this Bursary, having the value of Three Hundred Dollars, annually, commencing in 1939, and named in memory of their founder and first president, Mrs. Edith Tyrrell. A medal donated by Dr. Tyrrell accompanies the Bursary. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE CALIFORNIA STANDARD COMPANY UNDERGRADUATE SCHOLARSHIPS

The California Standard Company has donated two Scholarships in the Faculty of Applied Science and Engineering, each of a value of $375.00, to be awarded upon the basis of the examinations of the Third Year. One scholarship is open to students in Applied Geology, Mining Engineering or Engineering Physics, the other scholarship to any student in any Engineering Course including those already named. The awards are intended primarily to interest students in oil exploration and production.

The first awards were made at the end of the Session 1951–52.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Department of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endowment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course of Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00 is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of the income from a fund, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examination of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris, C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income from $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the Examinations of the Second Year.

SPRUCE FALLS POWER AND PAPER COMPANY LIMITED SCHOLARSHIPS

The Spruce Falls Power and Paper Company Limited has established four Scholarships of a value of $250.00 each, two in the Second Year known as the Egerton S. Noble Scholarships and two in the Third Year known as the Charles H. Sage Scholarships. They are awarded on the results of the Annual Examinations of the Second and Third Years to the students who stand first and second at the examinations of their respective years and are open to students in all courses in the Faculty. The first awards were made on the results of the examinations of 1951.

THE F. W. BALDWIN PRIZE

The F. W. Baldwin Prize of a value of $25.00 was established by the trustees of a fund created by the members of the Number 3 Squadron, University Air Training Corps 1941–44, in memory of Frederick Walker "Casey" Baldwin, a graduate of the School of Practical Science, who made a significant contribution in the field of Aeronautics in Canada; and who flew, on March 12th, 1908, near Hammondsport, N.Y., the "Redwing," the first biplane built by the Aerial Experiment Association.

It is awarded annually to the student registered in Third Year, Aeronautical Engineering who taking honours, ranks highest in the annual examinations of Third Year in "structural subjects."

The first award was made on the results of the examinations of the Session 1953–54.

THE J. A. D. McCURDY PRIZE

The J. A. D. McCurdy Prize of a value of $25.00 was established by the trustees of a fund created by the members of the Number 3 Squadron, University Air Training Corps (1941–44) in honour of John Alexander Douglas McCurdy, a graduate of the School of Practical Science, who "made the first flight in Canada on February 23rd, 1909, with a heavier-than-air machine."

It is awarded annually to the student registered in Third Year, Aeronautical Engineering who, taking honours, ranks highest in annual examinations of the Third Year in the subjects related to Aerodynamics.

The first award was made on the results of the examinations of the Session 1953–54.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Chief Accountant to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Seventy-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the Uni-

versity of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Fifty Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Course in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

KENNECOTT COPPER CORPORATION SCHOLARSHIP

The Kennecott Copper Corporation offers a scholarship of a value of $1000.00 annually to a student who has completed two or three years of the course in Mining Engineering. The award will be made on the following basis:

(*a*) primarily on proficiency in studies;
(*b*) enthusiasm, leadership, co-operativeness, initiative, ambition;
(*c*) good health and sturdy constitution;
(*d*) financial need.

The first award was available in 1948.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

A gift of books accompanies the medal.

ONTARIO CHAPTER, AMERICAN SOCIETY FOR METALS PRIZE

The Ontario Chapter, American Society for Metals offers a prize of $50.00 to a student registered in the graduating class in Metallurgical Engineering. The award is made annually, commencing 1951, on the recommendation of the staff in the Department of Metallurgical Engineering, primarily on the basis of a Thesis on either physical or extractive metallurgy. The prize may be held along with any other award.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgy Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

R.C.E. MEMORIAL SCHOLARSHIP

The Memorial Fund Committee of the Royal Canadian Engineers has established the R.C.E. Memorial Scholarship of a value of One Hundred and Twenty-five Dollars, open to students who have successfully completed their second to last year in the Faculty of Applied Science and Engineering or the School of Architecture. A candidate must be a member in good standing of the Canadian Officers' Training Corps and have successfully completed one summer season's training. Selection is made on the basis of academic standing and of qualities of leadership.

Application forms may be obtained at the C.O.T.C. Orderly Room, 119 St. George St.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics.

In making the award consideration is given to academic standing, with special enphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

MASSEY-HARRIS-FERGUSON LIMITED SCHOLARSHIPS

Massey-Harris-Ferguson Limited has established two scholarships each of an annual value of $250.00, to be awarded on the recommendation of the Council of the Faculty of Applied Science and Engineering to students registered in the Fourth Year of the Courses in Mechanical Engineering or Engineering and Business. In making the award academic achievement, financial need, extra-curricular activities and such other factors as may be deemed appropriate will be taken into consideration.

Application should be made to the Secretary of the Faculty not later than 15th October.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power developments at Shipshaw on the Saguenay River, which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer for award in the Province of Ontario two out of ten of the Rhodes Scholarships for Canadians, each of the basic value

of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year given conditionally at Oxford or elsewhere abroad may be authorized in proper cases.

Each candidate must be a British subject with at least five years domicile in Canada and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year *for* which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

A candidate may apply either for the province in which he has his private home or residence, or for the province in which he has taken his university course.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., K.C., 5 Rosedale Road, Toronto 5, General Secretary for the Rhodes Scholarships in Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey or the appropriate provincial secretary on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this

University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be ineligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Dean MacFarlane, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

MCCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection

with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award.

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time as recommended by the School of Engineering Research, to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $1,200.00 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the

department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $1000 for a research in some field of pure or applied science; an additional amount of $200 is available for special equipment and supplies. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four Graduate Research Fellowships now having a potential value of $3,750.00 each ($1,250.00 a year payable in Canadian funds for a maximum of three

years). The fellowships are open to graduates of any approved University in Canada and are offered for graduate study leading to a Master's or Doctor's degree in the fields of Chemistry and/or Engineering (two fellowships), Geology (one fellowship), and Economics or Industrial Relations (one fellowship). Nomination of students for the fellowships is made by the University—such nominations to be received by Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st of each year. Nomination forms and information as to the terms of the fellowships are obtainable at the Registrar's Office

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships of the value of $1,500 each are open to graduates of any recognized university who propose to pursue advanced study and research in any branch of Engineering in the University of Toronto.

Forms of application may be obtained from the Secretary of the School of Graduate Studies. These should be returned together with a transcript of academic record and an outline of the proposed study and research not later than March 1st.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIP

The Spruce Falls Power and Paper Company Limited has established the Arthur Hays Sulzberger Fellowship for the encouragement of research in the Faculty, of an annual value of $1,000.00. It is open to graduates of the University of Toronto or of other recognized universities, but is restricted to Canadian Citizens. Application should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

NATIONAL SEWER PIPE COMPANY LIMITED SCHOLARSHIP

The National Sewer Pipe Company Limited has established a scholarship of a value of Five Hundred Dollars ($500.00) in the School of Graduate Studies. It is awarded annually to a student who undertakes to enroll in that School, proceeding to the degree of Master of Applied Science in the graduate Department of Civil Engineering and in the course in Public Health Engineering.

Applications must be submitted to the Secretary of the School of Graduate Studies on or before March 1st.

THE ATHLONE FELLOWSHIPS

His Majesty's Government in the United Kingdom have established a number of fellowships to be awarded annually to enable Canadian engineering graduates to take postgraduate training in the United Kingdom. These became available in 1951 when five fellowships were open to graduates of the University of Toronto immediately after graduation. Additional

fellowships are for award to graduates who have already spent some time in industry. The fellowships cover costs of transport, fees and maintenance and are normally tenable for a period of two years. They may be utilized for (*a*) works training in industry, (*b*) postgraduate university study, or (*c*) a combination of these. Candidates must be Canadian citizens or British subjects normally resident in Canada and should preferably be less than 27 years of age. Further information and application forms may be obtained from the Secretary of the Faculty.

THE UNIVERSITY OF MANCHESTER TORONTO FUND

The University of Manchester has accepted the gift of a sum of £1,699 from a Committee representing the parents of children who during the war were evacuated to Toronto and other places in Canada. The capital and any income arising therefrom will be used to make grants to Canadians wishing to conduct post-graduate studies and/or research in the University of Manchester, preference being given to students who have graduated from the University of Toronto. The total amount of grant or grants to any student will not exceed £100. Applications must be submitted to the Registrar of the University of Toronto on or before January 1st of the year in which the applicant wishes to enter the University of Manchester, together with transcripts of undergraduate and graduate record and outlines of the post-graduate studies and/or research to be followed at the University of Manchester.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and

interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham. The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. To be eligible, students must have obtained not less than sixty-six per cent. at their last annual examination. Further information may be obtained from the Secretary of the Faculty.

J. P. BICKELL FOUNDATION BURSARIES

The Trustees of the J. P. Bickell Foundation have established the J. P. Bickell Foundation Bursaries in the Faculty of Arts and the Faculty of Applied Science and Engineering. An applicant in the latter Faculty must be registered in the Second, Third or Fourth Years in Mining or

Geology. He must demonstrate financial need and have satisfactory academic standing.

Application must be made to the Registrar of the University.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty.

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund
S.A.E.—Canadian Section Loan Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of

the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SOCIETY OF AUTOMOTIVE ENGINEERS—CANADIAN SECTION LOAN FUND

The Society of Automotive Engineers—Canadian Section has established a loan fund of $600.00 in the Faculty of Applied Science and Engineering. Preference is given to students in good scholastic standing and engaged in studies relative to the automotive and aircraft industries, and to students in fourth, third and second years in that order. Particulars may be obtained from the Secretary of the Faculty.

SECTION XII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of its own students in respect of all matters arising or occurring in or upon its respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1953–54

Year	1	2	3	5	6	7	8	9	10	11	Total
I..	85	15	90	42	106	80	21	36	21	48	544
II..	75	11	94	34	80	66	10	10	12	47	439
III..	74	8	53	30	61	47	7	8	12	45	345
IV..	52	6	62	15	55	50	6	4	2	36	288
	286	40	299	121	302	243	44	58	47	176	1616

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